

Cristian
math
expressions



Grade 4

Volume 2

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Dear Family:

This unit includes the customary and metric measurement systems. During this unit, students will become familiar with metric units of length, liquid volume, and mass, as well as the size of each when compared to each other.

One **meter** is about the distance an adult man can reach, or a little longer than a yard.

One **liter** is about two large glasses of liquid, or a little more than a quart.

One **gram** is about the mass of a paper clip or a single peanut.

One **kilogram** is a little more than 2 pounds.

Students will also discover that the metric system is based on multiples of 10. Prefixes in the names of metric measurements tell the size of a measure compared to the size of the base unit.

Units of Length

<u>kilometer</u>	<u>hectometer</u>	<u>decameter</u>	<u>meter</u>	<u>decimeter</u>	<u>centimeter</u>	<u>millimeter</u>
km	hm	dam	m	dm	cm	mm
$10 \times 1 \text{ hm}$	$10 \times 1 \text{ dam}$	$10 \times 1 \text{ m}$	$10 \times 1 \text{ dm}$	$10 \times 1 \text{ cm}$	$10 \times 1 \text{ mm}$	
1 km	1 hm	1 dam		10 dm	100 cm	1,000 mm
= 1,000 m	= 100 m	= 10 m		= 1 m	= 1 m	= 1 m

The most commonly used length units are **kilometer**, **meter**, **centimeter**, and **millimeter**.

The most commonly used units of liquid volume are **liter** and **milliliter**.

The most commonly used units of mass are **gram**, **kilogram**, and **milligram**.

Students solve real world problems involving metric and customary measures including finding perimeter and area of rectangles.

If you have any questions or comments, please contact me.

Sincerely,
Your child's teacher

Estimada familia:

Esta unidad incluye el sistema métrico y usual de medidas. Durante esta unidad, los estudiantes se familiarizarán con unidades métricas de longitud, volumen del líquido y masa, así como con el tamaño de cada una comparada con las otras.

Un **metro** es aproximadamente la distancia que un hombre adulto puede alcanzar extendiendo el brazo, o un poco más de una yarda.

Un **litro** es aproximadamente dos vasos grandes de líquido, o un poco más de un cuarto de galón.

Un **gramo** es aproximadamente la masa de un clip o un cacahuate.

Un **kilogramo** es un poco más de 2 libras.

Los estudiantes también descubrirán que el sistema métrico está basado en múltiplos de 10. Los prefijos de los nombres de las medidas métricas indican el tamaño de la medida comparado con el tamaño de la unidad base.

Unidades de longitud

kilómetro	hectómetro	decámetro	metro	decímetro	centímetro	milímetro
km	hm	dam	m	dm	cm	mm
$10 \times 1 \text{ hm}$	$10 \times 1 \text{ dam}$	$10 \times 1 \text{ m}$	$10 \times 1 \text{ dm}$	$10 \times 1 \text{ cm}$	$10 \times 1 \text{ mm}$	
1 km	1 hm	1 dam		10 dm	100 cm	1,000 mm
= 1,000 m	= 100 m	= 10 m		= 1 m	= 1 m	= 1 m

Las unidades de longitud más comunes son **kilómetro**, **metro**, **centímetro** y **milímetro**.

Las unidades de volumen del líquido más comunes son **litro** y **mililitro**.

Las unidades de masa más comunes son **gramo**, **kilogramo** y **miligramo**.

Los estudiantes resuelven problemas del mundo real que incluyen medidas usuales y métricas para hallar el perímetro y el área de rectángulos.

Si tiene alguna pregunta o algún comentario, por favor comuníquese conmigo.

Atentamente,
El maestro de su niño

**centimeter
(cm)**

**fluid ounce
(fl oz)**

cup (c)

foot (ft)

**decimeter
(dm)**

formula

A unit of liquid volume in the U.S. customary system.
 $8 \text{ fluid ounces} = 1 \text{ cup}$

A unit of measure in the metric system that equals one hundredth of a meter.
 $100 \text{ cm} = 1 \text{ m}$

A U.S. customary unit of length equal to 12 inches.

A unit of liquid volume in the U.S. customary system that equals 8 fluid ounces.

An equation with letters or symbols that describes a rule.

The formula for the area of a rectangle is:

$$A = l \times w$$

where A is the area, l is the length, and w is the width.

A unit of measure in the metric system that equals one tenth of a meter.
 $10 \text{ dm} = 1 \text{ m}$

gallon (gal)

kilogram (kg)

gram (g)

kiloliter (kL)

inch (in.)

**kilometer
(km)**

A unit of mass in the metric system that equals one thousand grams.
 $1 \text{ kg} = 1,000 \text{ g}$

A unit of liquid volume in the U.S. customary system that equals 4 quarts.

A unit of liquid volume in the metric system that equals one thousand liters.
 $1 \text{ kL} = 1,000 \text{ L}$

The basic unit of mass in the metric system.

A unit of length in the metric system that equals 1,000 meters.
 $1 \text{ km} = 1,000 \text{ m}$

A U.S. customary unit of length.

Example:



length

liter (L)

line plot

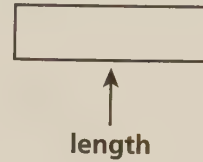
mass

liquid volume

meter (m)

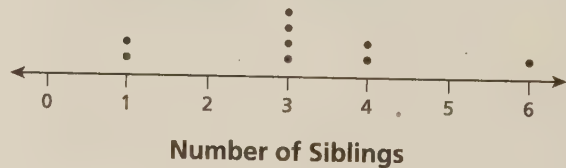
The basic unit of liquid volume in the metric system.
1 liter = 1,000 milliliters

The measure of a line segment or the distance across the longer side of a rectangle.



The measure of the amount of matter in an object.

A diagram that shows the frequency of data on a number line. Also called a dot plot.



The basic unit of length in the metric system.

A measure of the space a liquid occupies.

metric system

milliliter (mL)

mile (mi)

**millimeter
(mm)**

**milligram
(mg)**

ounce (oz)

A unit of liquid volume
in the metric system.
 $1,000 \text{ mL} = 1 \text{ L}$

A base ten system of
measurement.

A unit of length in
the metric system.
 $1,000 \text{ mm} = 1 \text{ m}$

A U.S. customary unit of
length equal to 5,280 feet.

A U.S. customary unit of
weight.
 $16 \text{ ounces} = 1 \text{ pound}$

A U.S. customary unit of liquid
volume (also called a fluid
ounce). $8 \text{ ounces} = 1 \text{ cup}$

A unit of mass in the
metric system.
 $1,000 \text{ mg} = 1 \text{ g}$

perimeter

quart (qt)

pint (pt)

ton

pound (lb)

width

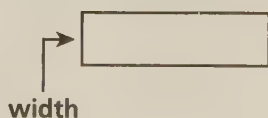
A U.S. customary unit of liquid volume that equals 32 fluid ounces or 4 cups.

The distance around a figure.

A U.S. customary unit of weight that equals 2,000 pounds.

A U.S. customary unit of liquid volume that equals 16 fluid ounces.

The distance across the shorter side of a rectangle.



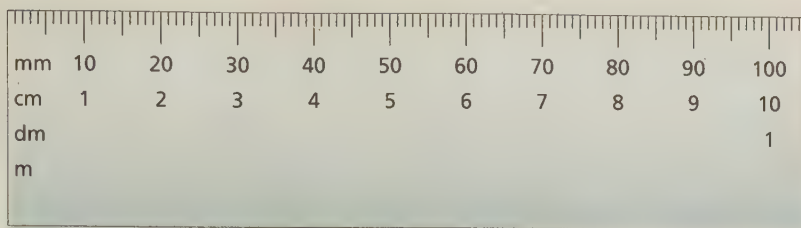
A unit of weight in the U.S. customary system.

yard (yd)

A U.S. customary unit of
length equal to 3 feet.

Parts of a Meter

Find these units on your meter strip.



VOCABULARY

millimeter
centimeter
decimeter
meter

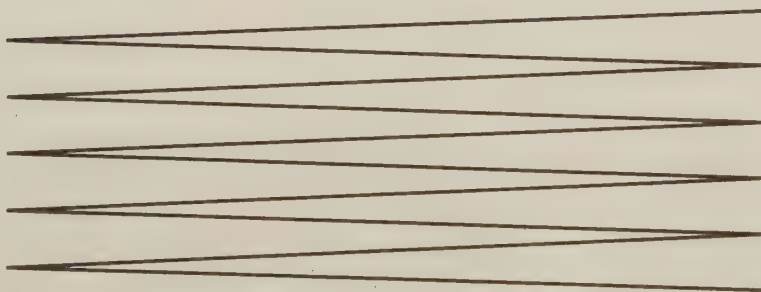
- Find one **millimeter** (1 mm) on your strip.
What objects are about 1 mm wide?

- Find one **centimeter** (1 cm) on your strip.
How many millimeters are in 1 cm?

- What objects are about 1 centimeter wide?

- Find one **decimeter** (1 dm) on your strip.
How many centimeters are in 1 decimeter?

This is one **meter** (1 m) that has been folded into decimeters to fit on the page.



- How many decimeters are in 1 meter?

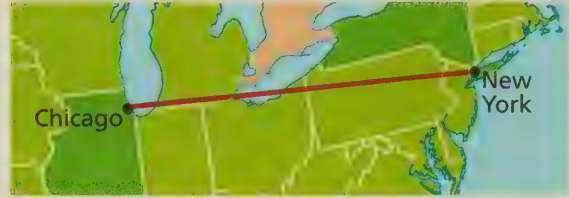
Choose Appropriate Units

Record which metric unit of length is best for measuring each object. Be prepared to justify your thinking in class.

6



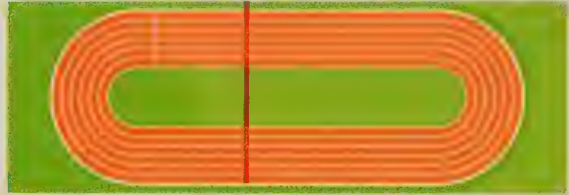
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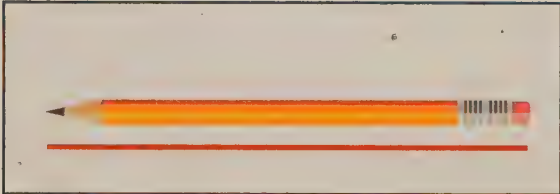
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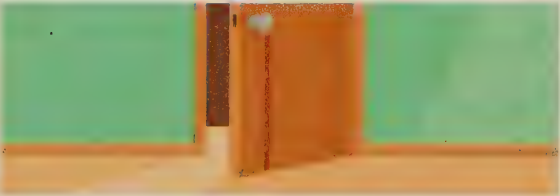
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11



12



13



Metric Prefixes

VOCABULARY

kilometer
metric system

Units of Length

kilometer	hectometer	decameter	meter	decimeter	centimeter	millimeter
km	hm	dam	m	dm	cm	mm
$10 \times 1 \text{ hm}$	$10 \times 1 \text{ dam}$	$10 \times 1 \text{ m}$	$10 \times 1 \text{ dm}$	$10 \times 1 \text{ cm}$	$10 \times 1 \text{ mm}$	
1 km	1 hm	1 dam		10 dm	100 cm	1,000 mm
= 1,000 m	= 100 m	= 10 m		= 1 m	= 1 m	= 1 m

- 14 What words do you know that can help you remember what the prefixes (kilo-, hecto-, deca-, deci-, centi-, milli-) mean in the **metric system**?

- 15 How do the lengths of the different units relate to each other?

- 16 How many meters are in 1 **kilometer**?

- 17 How many millimeters are in 1 m?

- 18 How many centimeters are in 1 m?

- 19 What makes the metric system easy to understand?

Convert Metric Units of Measure

You can use a table to convert measurements.

- 20** How many decimeters are in one meter? _____

- 21** Complete the equation.

1 meter = _____ decimeters

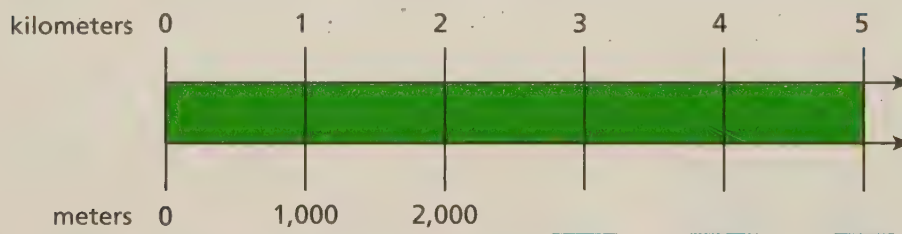
- 22** Complete the table. Explain how you found the number of decimeters in 8 meters.

Meters	Decimeters
2	$2 \times 10 = 20$
4	$\underline{\quad} \times 10 = \underline{\quad}$
6	$6 \times \underline{\quad} = \underline{\quad}$
8	$\underline{\quad} = \underline{\quad}$

You can also use a number line to convert measurements.

- 23** Complete the equation. 1 kilometer = _____ meters

- 24** Label the double number line to show how kilometers (km) and meters (m) are related.



Solve each problem. Label your answers with the correct units.

- 25** Marsha drove her car 6,835 kilometers last year. How many meters did Marsha drive last year?

- 26** John's television is 160 centimeters wide. How many millimeters wide is the television?

Solve.

- 27** 5 m = _____ cm **28** 3 hm = _____ m **29** 7 km = _____ m

✓ Check Understanding

Describe the relationship between meters and kilometers, decimeters, centimeters, and millimeters.

Measure Liquid Volume

The base metric unit of **liquid volume** is a **liter**.

VOCABULARY

liquid volume
liter
milliliter
kiloliter

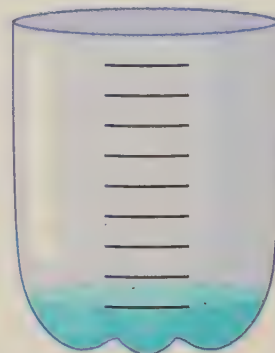
Units of Liquid Volume

<u>kiloliter</u>	<u>hectoliter</u>	<u>decaliter</u>	<u>liter</u>	<u>deciliter</u>	<u>centiliter</u>	<u>milliliter</u>
kL	hL	daL	L	dL	cL	mL
$10 \times 1 \text{ hL}$	$10 \times 1 \text{ daL}$	$10 \times 1 \text{ L}$	$10 \times 1 \text{ dL}$	$10 \times 1 \text{ cL}$	$10 \times 1 \text{ mL}$	
1 kL	1 hL	1 daL		10 dL	100 cL	1,000 mL
= 1,000 L	= 100 L	= 10 L		= 1 L	= 1 L	= 1 L

Ms. Lee cut a two-liter plastic bottle in half to make a one-liter container. She marked the outside to show equal parts.

- 1 How many **milliliters** of water will fit in the container?

- 2 How many of these plastic containers will fill a **kiloliter** container? Explain why.

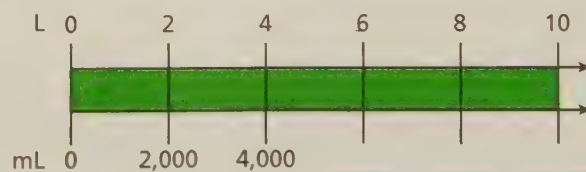


You can use a table or a double number line to convert units of liquid measure.

- 3 Complete the table.

Liters	Deciliters
3	$3 \times 10 = 30$
5	$\underline{\quad} \times 10 = \underline{\quad}$
7	$7 \times \underline{\quad} = \underline{\quad}$
12	$\underline{\quad} = \underline{\quad}$

- 4 Label the double number line to show how liters (L) and milliliters (mL) are related.



What's the Error?

Dear Math Students,

Today I had to solve this problem.

Meredith wanted to make some punch for a party. The recipe to make the punch called for 3 liters of fruit juice, 2 liters of apple juice, and 1 liter of grape juice. How many milliliters of juice is needed for the recipe? I said that the recipe calls for 600 milliliters of juice.

Here is how I solved the problem.

$$3\text{ L} + 2\text{ L} + 1\text{ L} = 6\text{ L} \times 100 = 600\text{ mL}$$

Is my answer correct? If not, please help me understand why it is wrong.

Your friend,

Puzzled Penguin



- 5 Is Puzzled Penguin correct? Explain your thinking.

- 6 Use the table to show the conversion from liters to milliliters for each type of juice needed for the recipe.

Liters	Milliliters

- 7 Describe another way that you could show the conversion from liters to milliliters for each type of juice.

Measure Mass

The basic unit of **mass** is a **gram**.

VOCABULARY

mass
gram
kilogram
milligram

Units of Mass

kilogram	hectogram	decagram	gram	decigram	centigram	milligram
kg	hg	dag	g	dg	cg	mg
$10 \times 1 \text{ hg}$	$10 \times 1 \text{ dag}$	$10 \times 1 \text{ g}$	$10 \times 1 \text{ dg}$	$10 \times 1 \text{ cg}$	$10 \times 1 \text{ mg}$	
1 kg	1 hg	1 dag		10 dg	100 cg	1,000 mg
= 1,000 g	= 100 g	= 10 g		= 1 g	= 1 g	= 1 g

8 How many **milligrams** are equal to 1 gram? _____

9 How many grams are equal to 1 **kilogram**? _____

If you weighed 1 mL of water, you would find that its mass would be one gram (1 g).

10 Is the gram a small or large unit of measurement?
Explain your thinking.

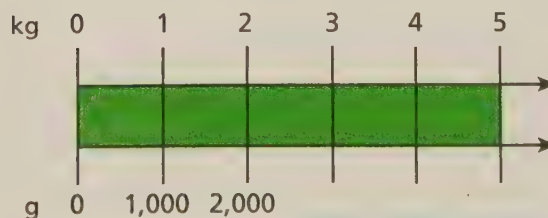
Convert Mass

You can use a table or a double number line to convert units of mass.

11 Complete the table.

Grams	Milligrams
4	$4 \times 1,000 = 4,000$
8	$\underline{\quad} \times 1,000 = \underline{\quad}$
12	$12 \times \underline{\quad} = \underline{\quad}$
15	$\underline{\quad} = \underline{\quad}$

12 Label the double number line to show how kilograms (kg) and grams (g) are related.



Practice Converting Metric Units

Solve.

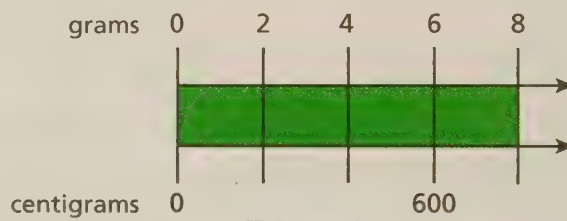
- 13** Martin measured the mass in grams of four different objects and recorded the information in the table below. Complete the table to find the mass of each object in milligrams.

Grams	Milligrams
4	4,000
7	
11	
15	

- 14** Olivia bought four different-sized containers and filled them each with water. She recorded the liquid volume of each container in liters below. Complete the table to find the liquid volume of each container in centiliters.

Liters	Centiliters
1	
3	
4	400
6	

- 15** Hayden has a crayon with a mass of 8 grams. Complete the double number line to find the mass of the crayon in centigrams.



- 16** Jennifer buys a 2-liter bottle of apple juice and a 3-liter bottle of orange juice at the market. How many deciliters of juice does Jennifer buy in all?
-

- 17** Elena has a cat with a mass of 4 kilograms. Ginger's dog has a mass that is 2 times as much as Elena's cat. What is the mass of Ginger's dog in grams?
-

✓ Check Understanding

Draw and label a double number line to show the relationship between liters and kiloliters. Include whole numbers from 0 to 10 to represent kiloliters.



Basic Units of Time

Complete the table.

Units of Time	
1 1 minute = _____ seconds	5 1 year = _____ days
2 1 hour = _____ minutes	6 1 year = _____ weeks
3 1 day = _____ hours	7 1 year = _____ months
4 1 week = _____ days	8 1 leap year = _____ days

Convert Units of Time

Complete the table.

9

Days	Hours
1	24
2	
3	
4	

10

Hours	Minutes
1	60
3	
5	
7	

11

Years	Months
3	36
6	
9	
12	

12

Hours	Seconds
1	3,600
2	
3	
4	

Solve.

13 36 minutes = _____ seconds

14 41 days = _____ hours

15 72 hours = _____ minutes

16 16 weeks = _____ days

17 6 years = _____ days

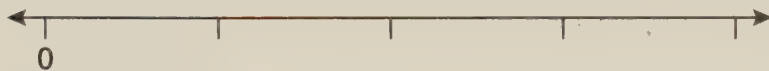
18 2 weeks = _____ hours

Make a Line Plot

A **line plot** displays data above a number line. Jamal asked his classmates about the time they spend reading. He organized the data in a table.

VOCABULARY
line plot

- 19 Use the table to complete the line plot.



Time Spent Reading Each Night (in hours)

- 20 How many classmates did Jamal ask about time spent reading? _____
- 21 What amount of time had the most responses? _____

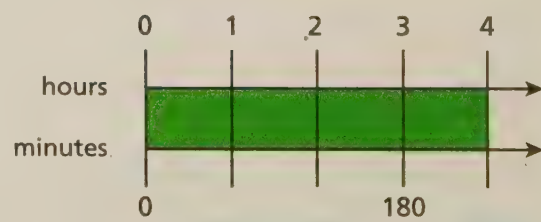
Time Spent Reading	Number of Students
0 hours	0
$\frac{1}{4}$ hour	2
$\frac{1}{2}$ hour	5
$\frac{3}{4}$ hour	4
1 hour	4

Practice

Solve.

- 22 Fiona asked her friends how much time they spend using a computer at home each night. Use the information in the table at right to make a line plot.
- 23 Marissa wants to know how many minutes she has practiced the piano. Label the double number line to show how hours and minutes are related. How many minutes has she practiced if she practiced for 4 hours?

Time Spent on Computer	Number of Students
0 hours	4
$\frac{1}{4}$ hour	4
$\frac{1}{2}$ hour	7
$\frac{3}{4}$ hour	3
1 hour	9



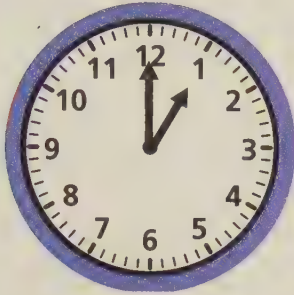
Read Elapsed Time

You can imagine clock hands moving to tell how much time has passed.

How many hours have passed since 12:00 on each clock?

How many minutes?

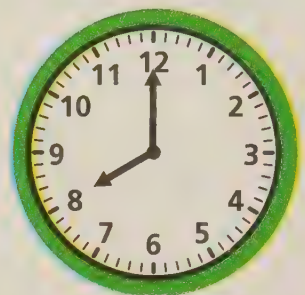
24



25



26



How many hours and how many minutes does the clock show?

Write the time that the clock shows.

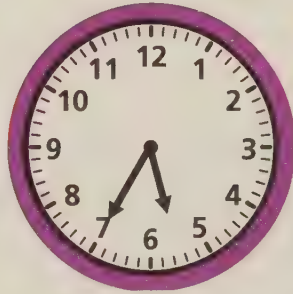
27



_____ hours

_____ minutes

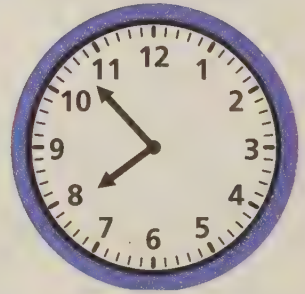
28



_____ hours

_____ minutes

29



_____ hours

_____ minutes

How many hours and minutes have passed between the times shown in:

30 Exercises 27 and 28

31 Exercises 28 and 29

32 Exercises 27 and 29

Solve Elapsed-Time Problems

Solve.

Show your work.

-  The school store is open for 1 hour 45 minutes in the afternoon. The store closes at 2:55 P.M. What time does the school store open?
- _____
-  Hannah's practice starts at 9:45 A.M. and ends at 12:35 P.M. How long is Hannah's practice?
- _____
-  Bella's dance class starts at 3:05 P.M. and lasts 1 hour 35 minutes. At what time does Bella's dance class end?
- _____
-  Lynn went to the mall with her mom. They arrived at the mall at 6:20 P.M. and left at 8:25 P.M. How long were Lynn and her mom at the mall?
- _____
-  It takes Reese 32 minutes to walk to school. She gets to school at 7:55 A.M. What time does Reese leave her house to walk to school?
- _____
-  Kevin baked a cake. He started making the cake at 8:03 P.M. It took him 1 hour 17 minutes to finish making the cake. What time did Kevin finish making the cake?
- _____

Check Understanding

Draw a line plot for the following data showing time spent exercising each day and the number of people:
0 hours, 1; $\frac{1}{4}$ hour, 5; $\frac{1}{2}$ hour, 3; $\frac{3}{4}$ hour, 6; 1 hour, 2.

VOCABULARY

inch
footyard
mile

Units of Length

- 1 This line segment is 1 **inch** long. Name an object that is about 1 inch long.



- 2 One **foot** is equal to 12 inches. Name an object that is about 1 foot long.

- 3 One **yard** is equal to 3 feet or 36 inches. Name an object that is about 1 yard long.

- 4 Longer distances are measured in miles. One **mile** is equal to 5,280 feet or 1,760 yards. Name a distance that is about 1 mile long.

Convert Customary Units of Length

- 5 Complete the table.

Feet	Inches
1	12
2	
3	
4	
5	

- 6 Complete the table.

Yards	Feet
2	6
4	
6	
8	
10	

Solve.

- 7 9 yards = _____ inches

- 8 26 feet = _____ inches

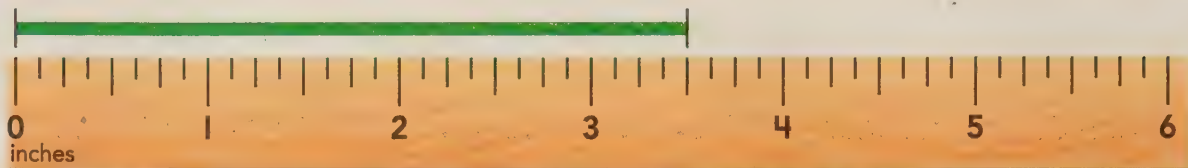
- 9 4 miles = _____ feet

- 10 2 miles = _____ yards

Measure Length

Write the measurement of each line segment to the nearest $\frac{1}{8}$ inch.

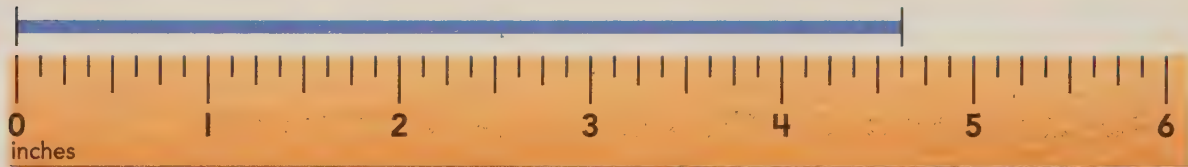
11



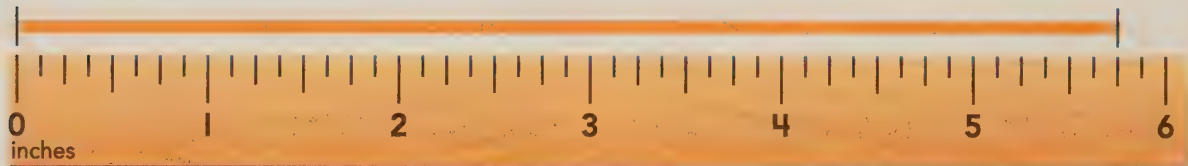
12



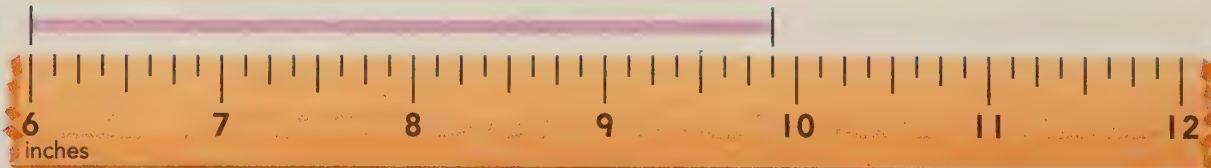
13



14



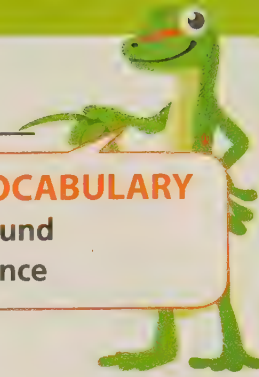
15



✓ Check Understanding

Explain how to convert a larger unit of length to a smaller unit of length using customary units. Give an example.

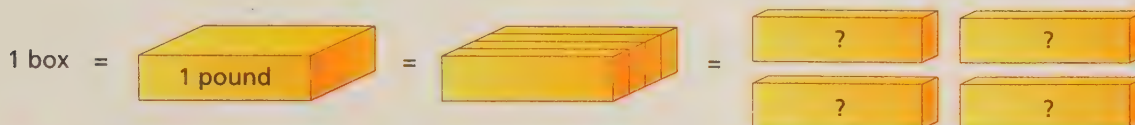
VOCABULARY

pound
ounce

Pounds and Ounces

The pound is the primary unit of weight in our customary system. One **pound** is equal to 16 **ounces**.

Butter and margarine are sold in 1-pound packages that contain four separately wrapped sticks.



- 1 What is the weight in ounces of one box?

- 2 What is the weight in ounces of one stick?

- 3 Kimba buys a bag of flour that weighs 5 pounds. Complete the table. How many ounces are equal to 5 pounds?

Pounds	Ounces
1	16
2	
3	
4	
5	

- 4 Describe how to convert pounds to ounces without using a table.

- 5 When Martin weighed his dog in April, the dog weighed 384 ounces. When he weighed the dog in August, the dog weighed 432 ounces. How many ounces did Martin's dog gain between April and August?

Tons

VOCABULARY

ton

The weight of heavy items such as cars, trucks, boats, elephants, and whales is measured in **tons**. One ton is equal to 2,000 pounds.

- 6 A ship weighs 12,450 tons. In pounds, the ship weighs 24,900,000 pounds. Which measure would you use to describe the weight of the ship? Why?

- 7 A trailer can carry 2 tons of cargo. How many pounds of cargo can the trailer carry?

- 8 One small package weighs 4 ounces. A shipment of small packages weighs a total of 1 ton. How many packages are in the shipment? Show your work.

Practice

Solve.

- 9 3 tons = _____ pounds
- 10 7 pounds = _____ ounces
- 11 5 tons = _____ pounds
- 12 12 pounds = _____ ounces
- 13 9 tons = _____ pounds
- 14 19 pounds = _____ ounces

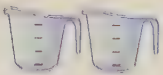
Liquid Volume

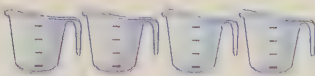
In the customary system, the primary unit of liquid volume is a **cup**.

VOCABULARY

cup pint
fluid ounce gallon
quart

1 cup  = 8 **fluid ounces**

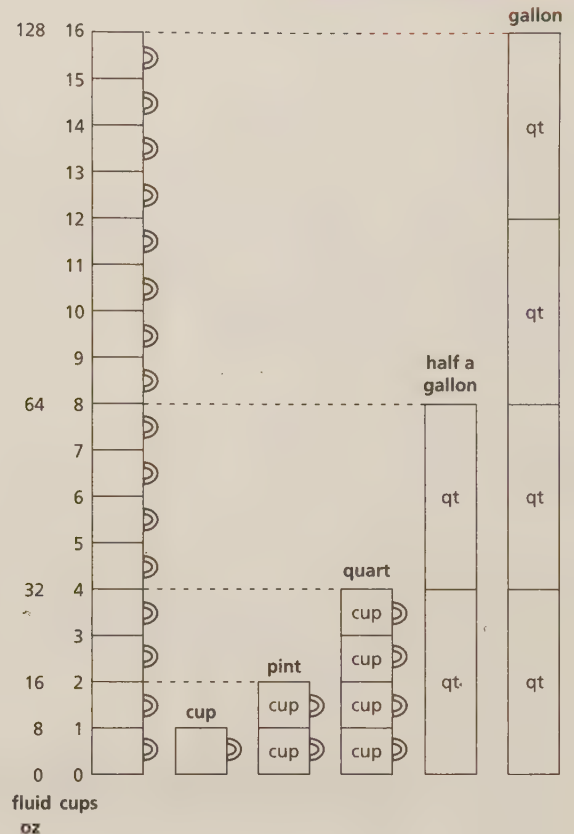
2 cups  = 1 **pint**

4 cups  = 1 **quart**

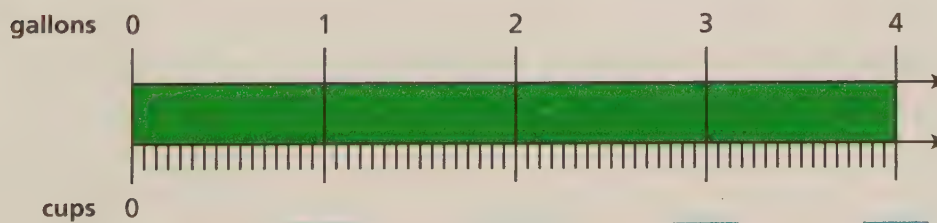
4 quarts = 1 **gallon**

15 Complete the table.

Quarts	Fluid Ounces
1	32
2	
3	
4	
5	
6	



16 Label the double number line to show how gallons (gal) and cups (c) are related.



Solve.

17 3 qt = _____ c

18 10 c = _____ fl oz

19 2 gal = _____ pt

Solve Real World Problems

Solve.

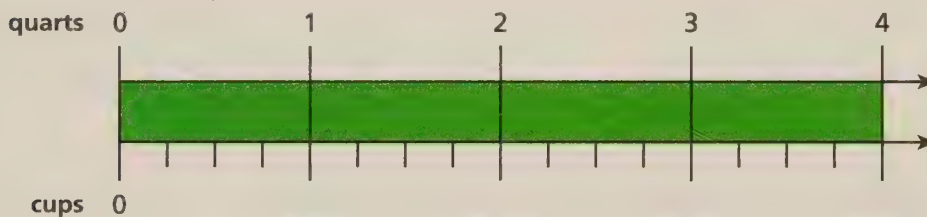
- 20 A race is 5 miles long. Complete the table.
How many feet are equal to 5 miles?

Miles	Feet
1	5,280
2	
3	
4	
5	

- 21 Sean has a watermelon that weighs 64 ounces. He cuts the watermelon into 8 pieces that each have the same weight.
How many ounces does each piece of watermelon weigh?

Show your work.

- 22 A container has 4 quarts of water left in it. Complete the double number line to show the relationship between quarts and cups. How many cups of water are left in the container?



- 23 Melinda buys 2 yards of fabric to make a banner.
How many feet of fabric does she buy? How many inches of fabric does she buy?

✓ Check Understanding

When converting from a larger unit of measure to a smaller unit, which operation do you use?

Convert.

1 $9 \text{ m} = \underline{\hspace{2cm}} \text{ cm}$

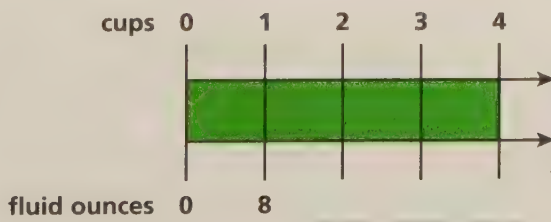
2 $5 \text{ L} = \underline{\hspace{2cm}} \text{ mL}$

Solve.*Show your work.*

- 3 Brianna started mowing the lawn at 1:40 P.M. She mowed for 55 minutes. At what time did Brianna stop mowing the lawn?
- _____

- 4 Sam cut a 28-foot rope into 4 equal pieces. How long is each piece of rope in inches?
- _____

- 5 Sadie drew a double number line to find the number of fluid ounces in 4 cups. What numbers for fluid ounces will complete the labels?



Add or subtract.

$$\begin{array}{r} 1 \quad 146 \\ + 313 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \quad 65,783 \\ + 37,149 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \quad 3,908 \\ + 281 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \quad 751 \\ - 340 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \quad 18,934 \\ + 7,225 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \quad 589,831 \\ + 46,230 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \quad 3,792 \\ + 1,436 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \quad 70,409 \\ - 7,382 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \quad 463 \\ + 572 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \quad 7,833 \\ - 6,312 \\ \hline \end{array}$$

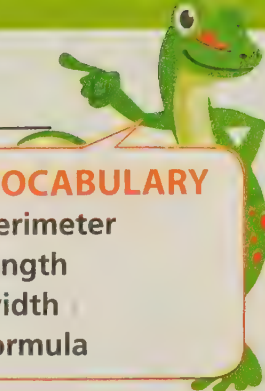
$$\begin{array}{r} 11 \quad 67,492 \\ - 28,561 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \quad 417 \\ - 332 \\ \hline \end{array}$$

$$\begin{array}{r} 13 \quad 954,612 \\ - 47,831 \\ \hline \end{array}$$

$$\begin{array}{r} 14 \quad 5,067 \\ - 3,543 \\ \hline \end{array}$$

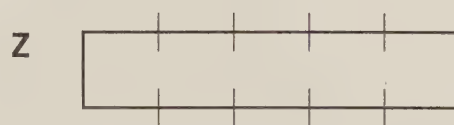
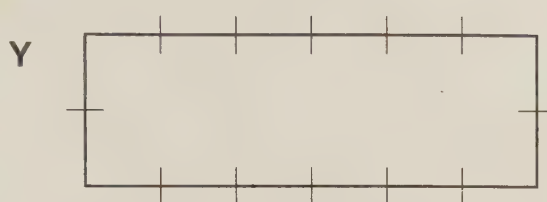
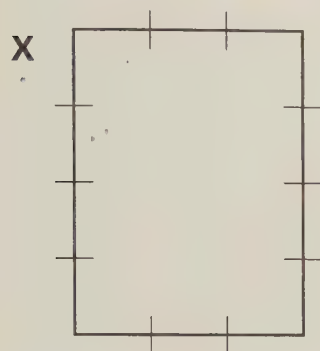
$$\begin{array}{r} 15 \quad 245,089 \\ - 117,395 \\ \hline \end{array}$$

**VOCABULARY**

perimeter
length
width
formula

Units of Perimeter

The prefix *peri-* means “around.” The suffix *-meter* means “measure.” **Perimeter** is the measurement of the distance around the outside of a figure.

**Key:**

= 1 cm

Length = l Width = w Perimeter = P

- 1** The measurement unit for these rectangles is 1 centimeter (1 cm). How can you find the total number of centimeters around the outside of each rectangle?

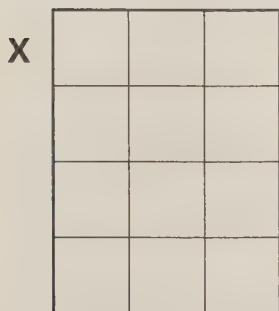
- 2** What is the perimeter of rectangle X? of rectangle Y? of rectangle Z?

- 3** How did you find the perimeter of each rectangle?

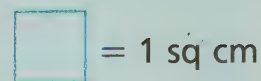
- 4** Look at the key at the top of the page: **length** is the distance across the longer side of a rectangle and **width** is the distance across the shorter side. Perimeter is the total distance around the outside. Use the letters l , w , and P to write a **formula** for the perimeter of a rectangle.

Units of Area

Area is the total number of square units that cover a figure. Each square unit inside these rectangles is 1 cm long and 1 cm wide, so it is 1 square centimeter (1 sq cm).



Key:



Length = l

Width = w

Area = A

- 5 How can you find the total number of square centimeters inside each rectangle?

- 6 What is the area of rectangle X? of rectangle Y? of rectangle Z?

- 7 Using l to stand for length, w to stand for width, and A to stand for area, what formula can you write for finding the area of any rectangle?

- 8 Why does the same formula work for all rectangles?

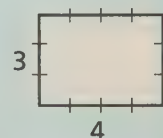
Review Perimeter and Area

Perimeter and Area

Perimeter and area are measured with different kinds of units: units of distance or length for perimeter and square units for area.

Perimeter is the total distance around the outside of a figure.

This rectangle has 4 units along its length and 3 units along its width. To find the perimeter, you add the distances of all of the sides:

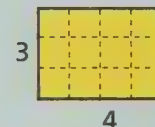


$$l + w + l + w = P$$

Area is the total number of square units that cover a figure.

For rectangles, area can be seen as an array of squares.

This rectangle is an array of 4 squares across (length) and 3 squares down (width). To find its area, you can multiply length times width:



$$l \times w = A$$

Practice with Perimeter and Area

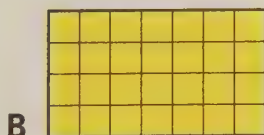
Find the perimeter of rectangle A. Find the area of rectangle B.

1 unit = 1 inch

9

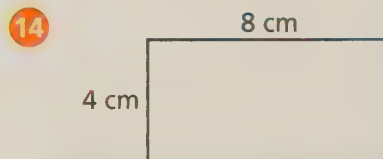
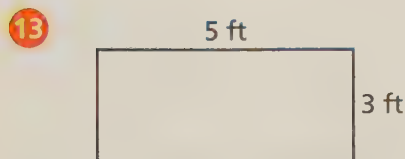
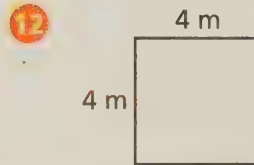
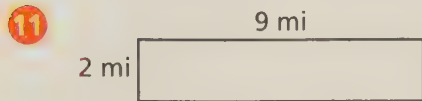


10



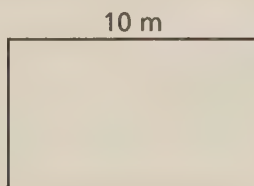
Calculate Perimeter and Area

Find the perimeter and area of each rectangle.

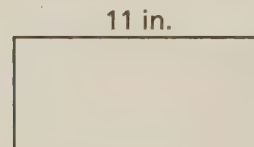


Solve.

- 15 The area of the rectangle is 60 square meters. One side of the rectangle has a length of 10 meters. What is the unknown side length?



- 16 The perimeter of the rectangle is 32 inches. One side of the rectangle has a length of 11 inches. What is the unknown side length?



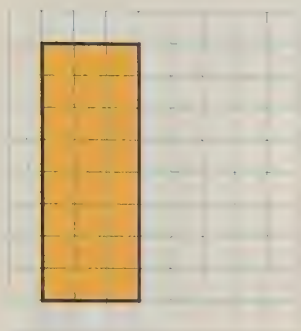
- 17 The perimeter of a rectangle is 56 mm. Three of the sides have a length of 15 mm, 13 mm, and 15 mm. What is the unknown side length?
-

- 18 The area of a rectangle is 81 square inches. One side of the rectangle has a length of 9 inches. What is the unknown side length?
-

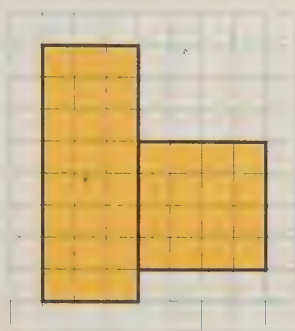
Explore Complex Figures

City Park has a rose garden. This year the city is planning to add a vegetable garden next to the rose garden. In these drawings, the side of each square unit represents 1 yard.

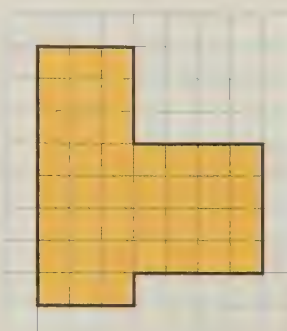
The rose garden:



Adding the vegetable garden:



The new garden:



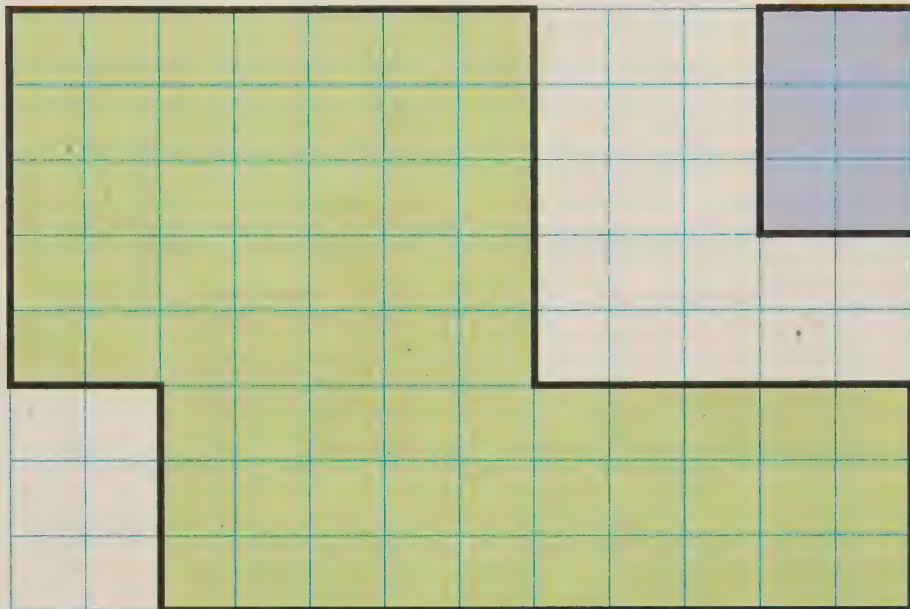
- 19 What is the shape of the rose garden? _____
- 20 What are its perimeter and area? _____
- 21 What is the shape of the vegetable garden? _____
- 22 What are its perimeter and area? _____
- 23 What is the area of the new garden? _____
- 24 What is the perimeter of the new garden? _____
- 25 Why is the area of the new garden the same as the area of the rose garden plus the area of the vegetable garden?

- 26 Why is the perimeter of the new garden not the same as the perimeter of the rose garden plus the perimeter of the vegetable garden?

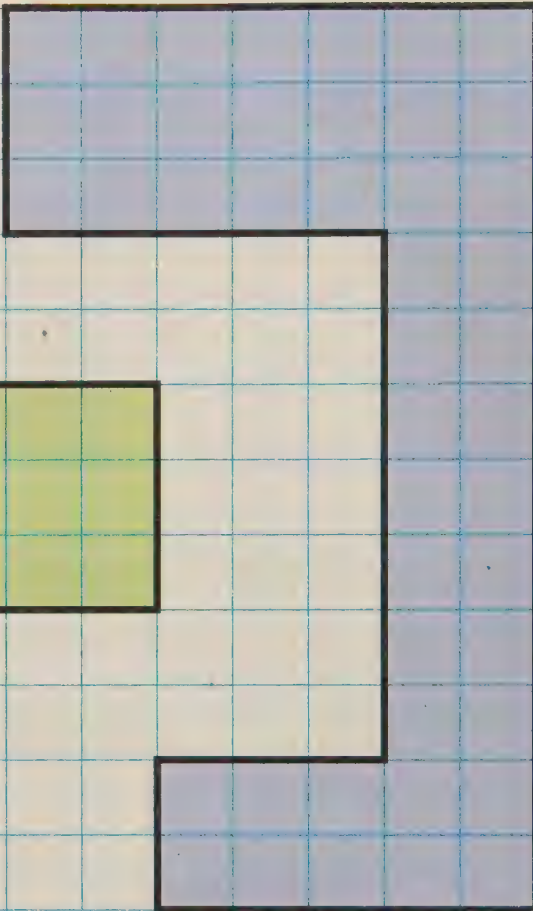
Perimeter and Area of Complex Figures

Find the perimeter and area of each figure.

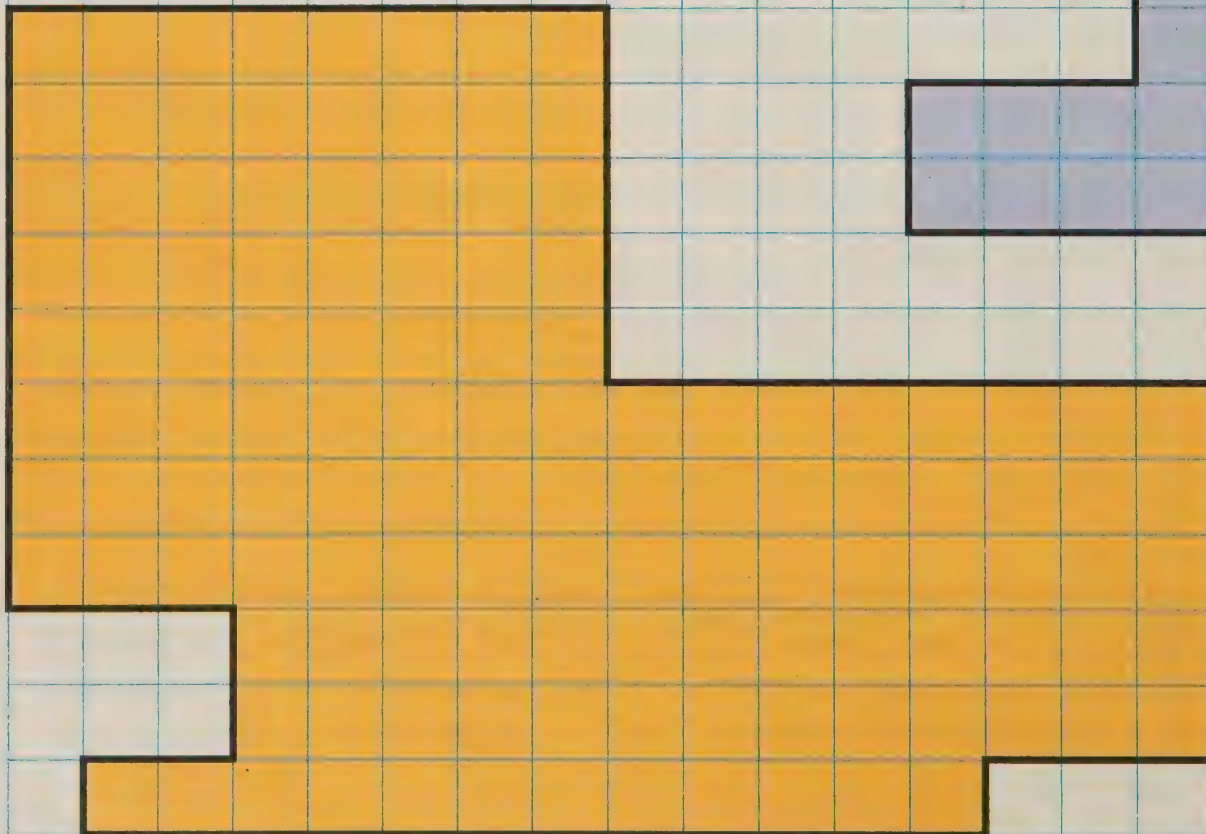
27



28



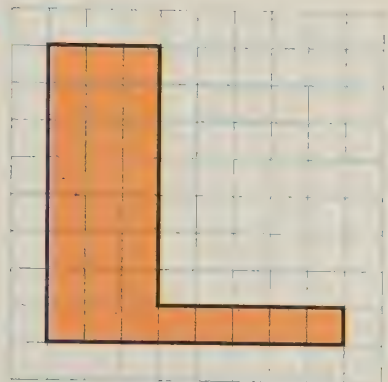
29



Perimeter and Area of Complex Figures (continued)

Find the perimeter of each figure. Then divide each figure into rectangles and find the area. In these drawings, the side of each square unit represents 1 yard.

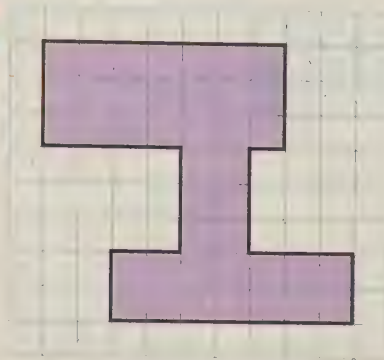
30



Perimeter: _____

Area: _____

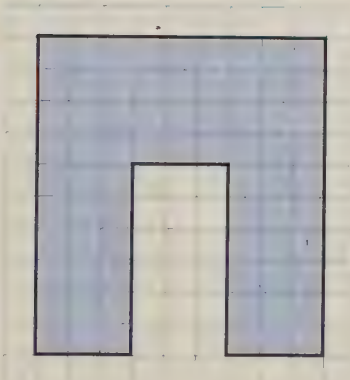
31



Perimeter: _____

Area: _____

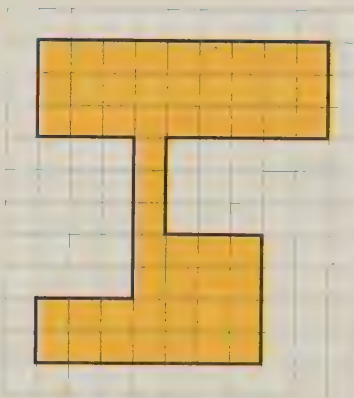
32



Perimeter: _____

Area: _____

33



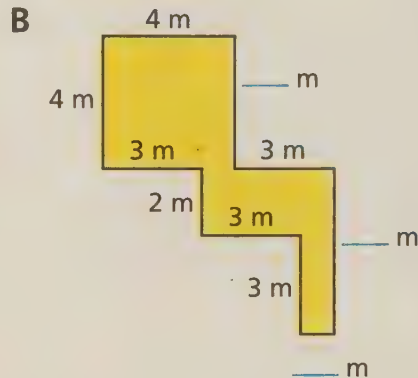
Perimeter: _____

Area: _____

34

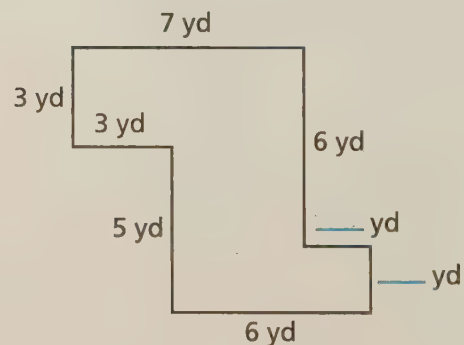
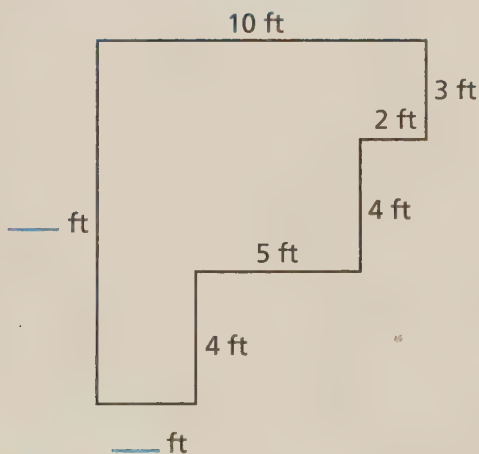
Explain why you divided the figure in Exercise 30 the way you did.

- A**
-
- 2 in.
- in.
- 5 in.
- 9 in.
- 3 in.
- in.
- 3 in.
- in.



- A:** **B:**

- 11** The drawing shows the plan for a new playground. What is the area? _____



Explain how to find the perimeter and area of a rectangle. Give examples as part of your explanation.



Solve Real World Measurement Problems

- 1 Ethan has a piece of string that is 6 meters long. *Show your work.*
He cuts the string into 3 pieces of equal length.
How many centimeters long is each piece of string?

- 2 Jamal put a cantaloupe with a mass of 450 grams in a bag. He adds another cantaloupe that had a mass of 485 grams. How many grams of cantaloupe are in the bag?

- 3 Tanisha has 35 milliliters of lemon juice. She divides the juice evenly into 5 different containers. How much juice does she pour into each container?

- 4 Katherine has some rocks that weigh 4 pounds. She put the rocks into 2 groups, each with the same weight. What is the weight of each group in ounces?

- 5 Grace buys a yellow ribbon that is 2 feet long and a pink ribbon that is 8 feet long. How many times as long is the pink ribbon as the yellow ribbon? How many inches of ribbon does Grace have in all?

- 6 Adriana has one gallon of juice. She pours the juice into containers that each hold one pint of juice. She gives two pints to her friends. How many pints of juice are left?

- 7 Jamison ran 1,780 feet yesterday. Today he ran 2,165 feet. How many yards did Jamison run the past two days?

Solve Real World Measurement Problems (continued)

- 8** A store sells 89 gallons of milk in May and 82 gallons of milk in June. Altogether, how many gallons of milk did the store sell in May and June?

Show your work.

- 9** Felix has a dog that weighs 38 pounds. Felix's dog weighs twice as much as Marcell's dog. In ounces, how much more does Felix's dog weigh than Marcell's dog?

- 10** Grant ran 500 meters around a track. Harry ran 724 meters around the same track. How many more meters did Harry run than Grant?

Perimeter and Area Word Problems

- 11** The area of the rectangular sandbox is 32 square feet. The short side of the sandbox measures 4 feet. How long is the long side of the sandbox?

- 12** One wall in Dennis's square bedroom is 13 feet long. What is the perimeter of Dennis's bedroom?

- 13** A square playground has an area of 900 square feet. What is the length of each side of the playground?

- 14** A rectangular rug has a perimeter of 20 feet. The length of the rug is 6 feet. What is the width of the rug in inches?

 Check Understanding

What formula could you use to solve Problem 12? _____



Math and Gardens

Gardens come in all shapes and sizes and can include flowers, vegetables, and many other plants. A Dutch garden is a type of garden that is often a rectangle made up of smaller rectangles and squares, called flowerbeds. A hedge or wall is often placed around the perimeter of the garden. Dutch gardens are known for having very colorful, tightly packed flowers. The Sunken Garden is a famous Dutch garden at Kensington Palace in London, England.



Jared looked up some information about taking care of a garden. He discovered that you need to water and fertilize a garden regularly to help the plants grow. The information he found is shown in the table at the right.

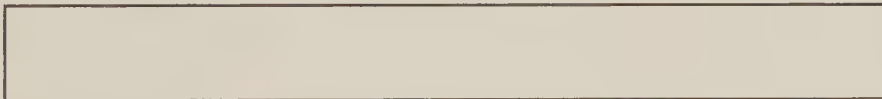
Gardening Information

Fertilizer	4 ounces per 100 sq feet
Water	30 gallons every 3 days

Use the diagram below to answer the questions. It shows a planned flowerbed for a Dutch garden. The perimeter of the flowerbed is 200 feet.

10 ft

?



- 1 What is the length of the unknown side?

Show your work.

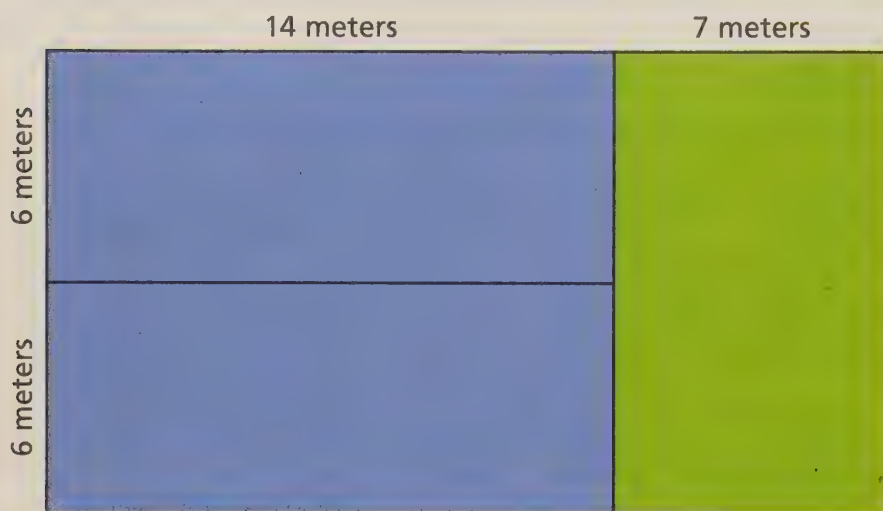
- 2 What is the area of the flowerbed?

- 3 How many ounces of fertilizer should be used on the flowerbed?

- 4 How many cups of water are used every 9 days?

Rectangles in Gardens

Padma wants to create a rectangular shaped garden in her backyard. She wants to have a total of three flowerbeds, two of which will be the same size. She drew a diagram of how she wants the garden to look: Use the diagram to answer the questions below.



- 5 What is the perimeter of the entire blue section of flowerbeds?

- 6 Which section of the garden has a greater perimeter, the green section or the entire blue section? How much greater?

- 7 What is the area of the whole garden?

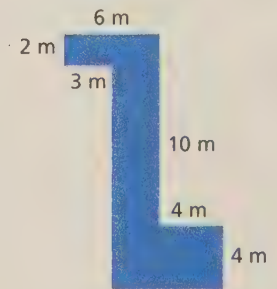
- 8 Padma decides to plant tulips in one of the blue flowerbeds and roses in the green flowerbed. Compare the area of the tulip flowerbed and the rose flowerbed using $>$, $<$, or $=$.

Show your work.

Solve.

Show your work.

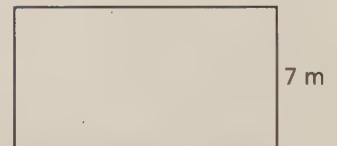
- 1 The drawing shows the plan for a path. What is the area of the path?



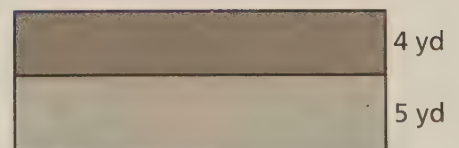
- 2 Hayden put 2 cups of lemon juice and 5 times as much water into a jar to make a jar of lemonade. How many fluid ounces of lemonade were in the jar?

- 3 Jasmine bought a 4-kilogram block of modeling clay. She wants to divide it into 8 equal blocks. What will be the mass of each block in grams?

- 4 The perimeter of the rectangle is 40 meters. What is the length of one of the long sides?



- 5 A crew is paving the parking lot shown in the diagram. They will pave it in two stages.



The total area of the parking lot is 207 square yards. What is the length of one of the long sides of the parking lot?

Add or subtract.

$$\begin{array}{r} 1 \quad 17,348 \\ + 4,419 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \quad 817 \\ - 736 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \quad 29,713 \\ - 1,882 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \quad 4,385 \\ - 2,241 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \quad 9,405 \\ + 793 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \quad 40,219 \\ - 34,477 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \quad 384 \\ + 614 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \quad 4,970 \\ - 3,548 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \quad 612,498 \\ - 61,579 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \quad 983 \\ - 302 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \quad 990,054 \\ - 247,175 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \quad 32,184 \\ + 68,472 \\ \hline \end{array}$$

$$\begin{array}{r} 13 \quad 7,569 \\ + 6,335 \\ \hline \end{array}$$

$$\begin{array}{r} 14 \quad 519,045 \\ + 453,788 \\ \hline \end{array}$$

$$\begin{array}{r} 15 \quad 578 \\ + 333 \\ \hline \end{array}$$

- 1 A photograph is 8 centimeters wide. After Kari enlarges the photograph, it is 3 times as wide as the original. How wide is the new photograph in millimeters?

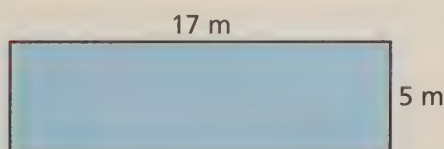
_____ millimeters

- 2 Describe the relationship between these units of time: hours, minutes, and seconds.

- 3 Complete the table that relates meters and centimeters.

Meters	Centimeters
1	_____
2	_____
3	300
4	_____

- 4 What is the area of the rectangle?



_____ square meters

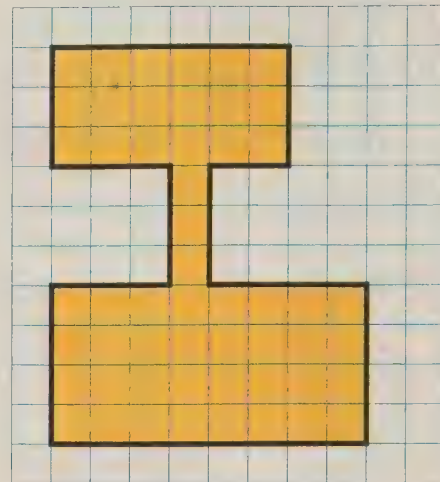
- 5 Classify the conversion below as using $\times 10$, $\times 100$, or $\times 1,000$. Write the letter of the conversion in the correct box.

A kilograms to grams**D** hectograms to decagrams**B** meters to centimeters**E** liters to milliliters**C** deciliters to centiliters**F** decameters to decimeters $\times 10$ $\times 100$ $\times 1,000$

- 6 The drawing shows plans for a sandbox. Find the perimeter and area of the sandbox if the side of each square unit represents 1 foot.

Perimeter: _____

Area: _____



- 7 For Exercises 7a and 7b, complete the conversion. Then choose the operation and complete the equation to show how you found your answer.

7a. 12 min = sec

12 = _____

$\times 60$

$\div 60$

$\times 24$

$\div 24$

7b. 96 hours = days

96 = _____

$\times 60$

$\div 60$

$\times 24$

$\div 24$

- 8 For Exercises 8a–8d, choose Yes or No to tell whether the conversion between the metric units is correct.

8a. Divide by 100 to convert kiloliters to decaliters.

☐ Yes

☐ No

8b. Multiply by 10 to convert milligrams to centigrams.

☐ Yes

☐ No

8c. Divide by 1,000 to convert grams to kilograms.

☐ Yes

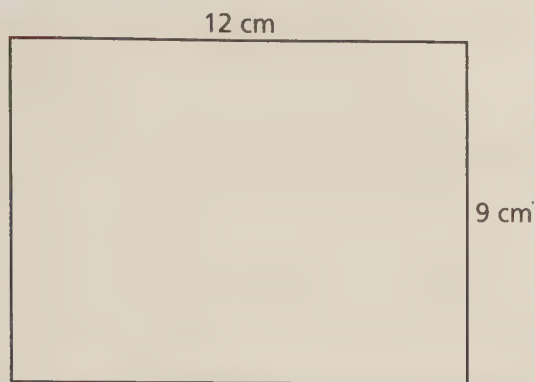
☐ No

8d. Divide by 10 to convert kilometers to hectometers.

☐ Yes

☐ No

- 9 Find the perimeter and area of the rectangle.



$$P = \boxed{} \text{ centimeters}$$

$$A = \boxed{} \text{ square centimeters}$$

- 10 Draw a line to match equivalent measurements.

48
inches
•

9
tons
•

24
cups
•

18
pounds
•

•
18,000
pounds

•
288
ounces

•
4
feet

•
192
fluid ounces

- 11 During a speech, a motivational speaker says, "There are 1,440 seconds in each day. How will you spend yours?" Do you agree or disagree with the speaker? Explain your reasoning using words and numbers.

A large empty rectangular box with a blue border, intended for the student to write their response to question 11.

- 12 A bear cub weighed 64 ounces in March. After three months, it weighed 31 pounds.

Part A

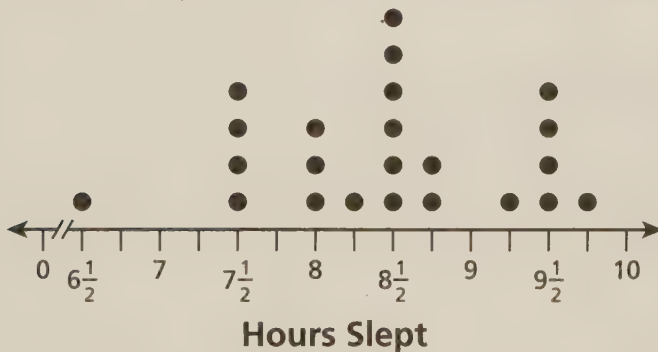
How many pounds did the cub weigh in March?

_____ pounds

Part B

Use words and numbers to show that the bear cub gained more than 25 pounds after three months.

- 13 Jill asked her classmates how many hours of sleep they got last night. She displayed the data in the line plot shown. How many classmates did Jill ask about the time spent sleeping?



Jill asked classmates.

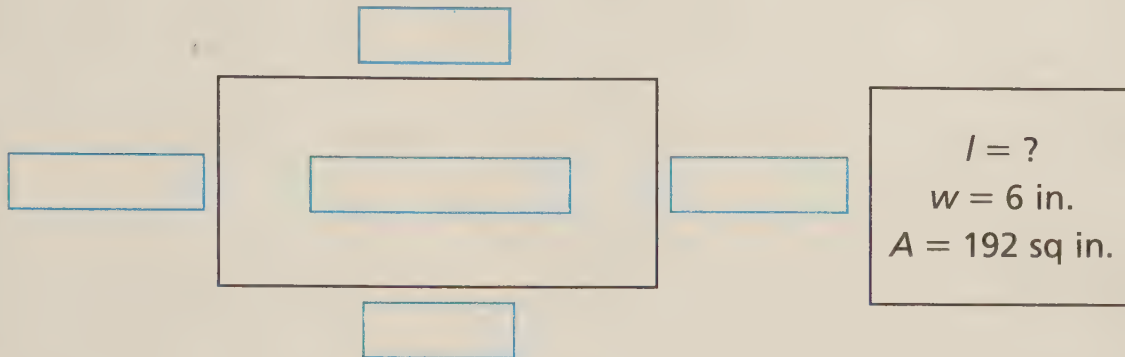
- 14 Which mass is equivalent to 55 decagrams? Mark all that apply.

- | | |
|----------------------|------------------------|
| (A) 55 kilograms | (D) 5 hectograms |
| (B) 550 grams | (E) 550,000 milligrams |
| (C) 5,500 centigrams | (F) 55,000 decigrams |

- 15 A rectangular scarf has an area of 192 square inches. The short sides of the scarf are each 6 inches long.

Part A

Use the labels from the list to complete the model. Labels can be used more than once.

**Part B**

What is the perimeter of the scarf? Show your work.

- 16 A rectangular cafeteria tray measures 18 inches on the long sides. It measures 12 inches on the short sides. What is the perimeter of the tray?

_____ inches

- 17 A bag of rice has a mass of 3 kilograms. Jackie buys 17 bags of rice for the school cafeteria. How many grams of rice did Jackie buy? Explain how you solved this problem.

- 18 For Exercises 18a–18e, choose True or False for the conversion.

18a. $8 \text{ ft} = 96 \text{ in.}$ ☐ True ☐ False

18b. $9 \text{ lb} = 72 \text{ oz}$ ☐ True ☐ False

18c. $8 \text{ pt} = 4 \text{ qt}$ ☐ True ☐ False

18d. $3 \text{ yd} = 36 \text{ ft}$ ☐ True ☐ False

18e. $4 \text{ gal} = 16 \text{ pt}$ ☐ True ☐ False

- 19 A movie starts at 12:45 P.M. and is exactly 1 hour 35 minutes long.

Part A

What time does the movie end?

Part B

It takes Lynn 25 minutes to get to the movie theater. She wants to meet her friends at the theater at least 15 minutes before the movie starts. What is the latest time Lynn can leave her house? Explain how you found your answer.

- 20 Choose a number from the first column and a unit from the second column to make a measurement that is equivalent to 2 meters.

Number	Unit
☐ 100	☐ decimeters
☐ 20,000	☐ centimeters
☐ 200	☐ millimeters

Patio Design Plans

Gio wants to build a fenced rectangular patio. He has a box of 36 one-foot by one-foot slate tiles.

- 1** List all the possible rectangular floor designs (length $\times$ width) using only whole tiles. Which floor designs do not make sense for this problem? Explain.

- 2** Find the perimeter for each floor plan. Why do some floor plans have the same perimeter?

- 3** Gio wants to include a fence around the patio. He needs to keep the cost under \$200. He is interested in two kinds of fence. One kind costs \$7 per foot and the other costs \$9 per foot. Which floor plans could he choose? Identify the least expensive choice.

- 4 Gio decides to use the floor plan that is 9 feet by 4 feet. He wants to put a rectangular table that is 48 inches long and 36 inches wide on the patio. Also, on one end of the patio, he wants to put a flower box that is 24 inches long and 12 inches wide. How much floor area will the table and the flower box cover? How much open area will remain for use on the patio? Explain how you solved the problem.

- 5 Suppose Gio changes his mind and decides the patio can be a combination of rectangular areas, such as an L-shape, instead of a single rectangular shape. Draw and label a diagram of the new design. Be sure to use all of the tiles. What is the perimeter of the patio you drew?

- 6 Gio estimates it will take about 15 minutes per tile to lay the 36 tiles. How many hours will it take him to build the patio? If he starts at 9:00 A.M. and takes a one-hour break at 12:00 noon, what time will he finish the patio? Show your work.

Dear Family:

Your child has experience with fractions through measurements and in previous grades. Unit 6 of *Math Expressions* builds on this experience. The main goals of this unit are to:

- understand the meaning of fractions.
- compare unit fractions.
- add and subtract fractions and mixed numbers with like denominators.
- multiply a fraction by a whole number.

Your child will use fraction bars and fraction strips to gain a visual and conceptual understanding of fractions as parts of a whole. Later, your child will use these models to add and subtract fractions and to convert between fractions equal to or greater than 1 and mixed numbers.

Examples of Fraction Bar Modeling:

Fraction Comparisons



$$\frac{1}{3} < \frac{1}{2}$$

Fraction Subtraction



$$\frac{5}{5} - \frac{2}{5} = \frac{3}{5}$$

Your child will apply this knowledge about fractions and fraction operations to solve real world problems.

If you have questions or problems, please contact me.

Sincerely,
Your child's teacher

Estimada familia:

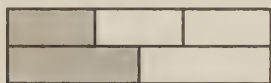
Su niño ha usado fracciones al hacer mediciones y en los grados previos. La Unidad 6 de *Math Expressions* amplía esta experiencia. Los objetivos principales de la unidad son:

- comprender el significado de las fracciones.
- comparar fracciones unitarias.
- sumar y restar fracciones y números mixtos con denominadores iguales.
- multiplicar una fracción por un número entero.

Su niño usará barras y tiras de fracciones para comprender y visualizar el concepto de las fracciones como partes de un entero. Luego, usará estos modelos para sumar y restar fracciones y para convertir fracciones igual a o mayor que 1 y números mixtos.

Ejemplos de modelos con barras de fracciones:

Comparaciones de fracciones



$$\frac{1}{3} < \frac{1}{2}$$

Resta de fracciones

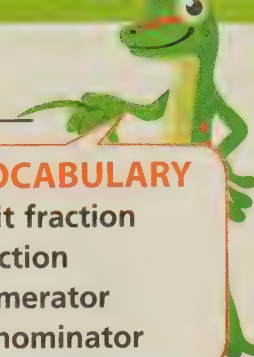


$$\frac{5}{5} - \frac{2}{5} = \frac{3}{5}$$

Su niño aplicará este conocimiento de las fracciones y operaciones con fracciones para resolver problemas cotidianos.

Si tiene alguna duda o algún comentario, por favor comuníquese conmigo.

Atentamente,
El maestro de su niño



Sums of Fractions

A **unit fraction** represents one equal part of a whole. A unit fraction has a numerator of 1. The unit fraction $\frac{1}{d}$ is one of d equal parts.

VOCABULARY

unit fraction
fraction
numerator
denominator

The fraction bar below is divided into six equal parts, or sixths. Each part is 1 of 6 equal parts, or $\frac{1}{6}$.



$\frac{1}{6}$

A **fraction** is the sum of unit fractions.

The fraction $\frac{n}{d}$ is the sum of n copies of $\frac{1}{d}$.

numerator $\rightarrow \frac{n}{d} = \frac{\text{number of unit fractions in the fraction}}{\text{number of equal parts in the whole}}$

denominator

The fraction $\frac{5}{6}$ is the sum of five $\frac{1}{6}$ unit fractions.

$$\frac{5}{6} = \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = 5 \times \frac{1}{6}$$

$$\frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} = \frac{5}{6}$$



Fold your fraction strips to show each sum of unit fractions. Write the fraction each sum represents.

1 $\frac{1}{3} + \frac{1}{3} =$ _____

2 $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} =$ _____

3 $\frac{1}{4} + \frac{1}{4} =$ _____

4 $\frac{1}{6} + \frac{1}{6} + \frac{1}{6} + \frac{1}{6} =$ _____

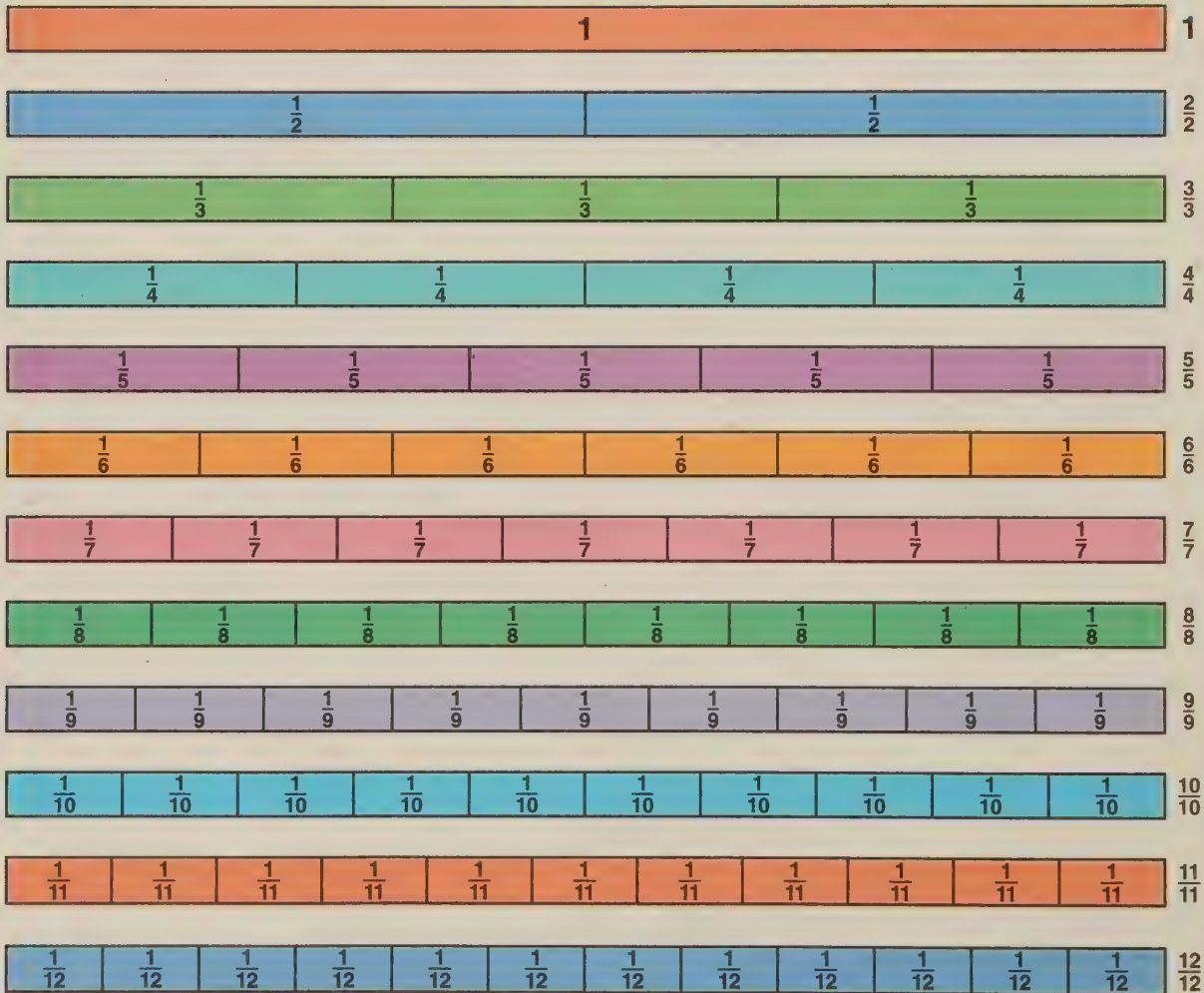
5 $\frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12} =$ _____

6 $\frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12} + \frac{1}{12} =$ _____

7 $\frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} + \frac{1}{8} =$ _____

Patterns in Fraction Bars

- 1** Describe at least three patterns you see in the fraction bars below.



Sums of Unit Fractions

Shade the fraction bar to show each fraction. Then write the fraction as a sum of unit fractions and as a product of a whole number and a unit fraction. The first one is done for you.

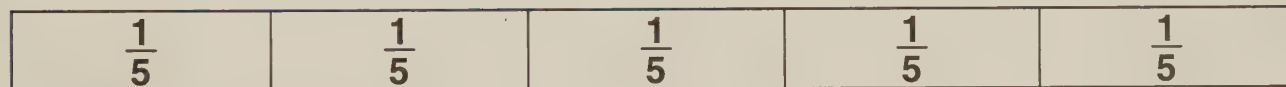
9 $\frac{3}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = 3 \times \frac{1}{4}$



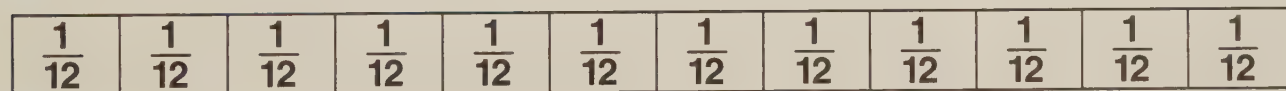
10 $\frac{3}{8} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$



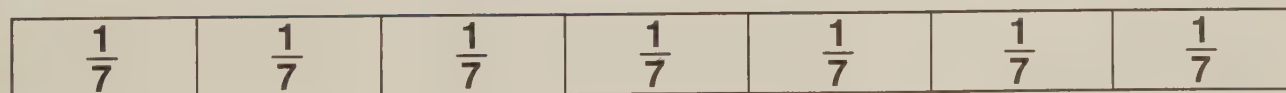
11 $\frac{5}{5} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$



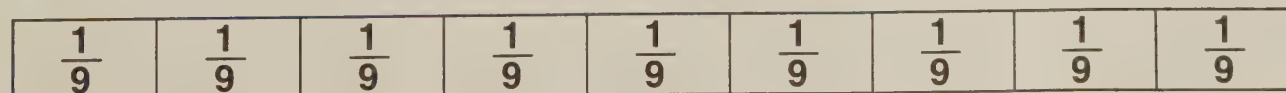
12 $\frac{2}{12} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$



13 $\frac{4}{7} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

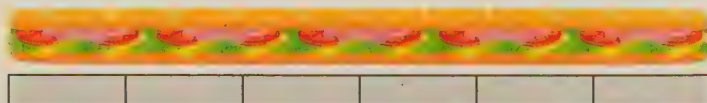


14 $\frac{7}{9} = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$



Fractions as Parts of a Whole

Jon made a large sandwich for the 6 people in his family. He asked his father to help him cut it into 6 equal pieces. To do this, they made a paper cutting guide that is as long as the sandwich. Jon folded the paper into 6 equal parts, and his father used it to cut the sandwich into equal pieces.



Solve.

Show your work.

- 15 If each person ate 1 piece of the sandwich, what fraction of the sandwich did each person eat? Fold your 6-part fraction strip to show the fraction of the whole sandwich that each person ate.

- 16 How many pieces of the whole sandwich did Jon's mother and father eat altogether? Fold your fraction strip to show the fraction of the whole sandwich Jon's mother and father ate in all.

- 17 After Jon's mother and father got their pieces, what fraction of the sandwich was left?

- 18 Jon and his sisters were each able to have one of the remaining pieces of the sandwich. How many sisters does Jon have?

✓ Check Understanding

Explain what a unit fraction is and how unit fractions are used to build other fractions.



Fifths that Add to One

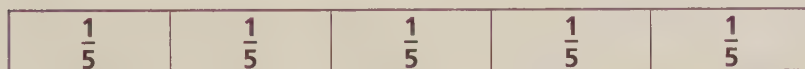
Every afternoon, student volunteers help the school librarian put returned books back on the shelves. The librarian puts the books in equal piles on a cart.

One day, Jean and Maria found 5 equal piles on the return cart. They knew there were different ways they could share the job of reshelving the books. They drew fraction bars to help them find all the possibilities.

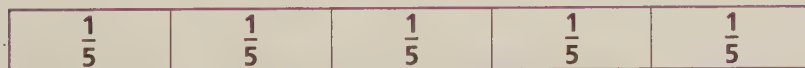
- 1** On each fifths bar, circle two groups of fifths to show one way Jean and Maria could share the work. (Each bar should show a different possibility.) Then complete the equation next to each bar to show their shares.

1 whole = all of the books

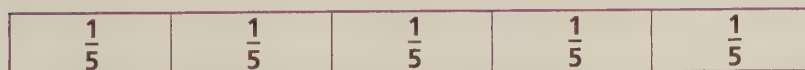
1 whole Jean's share Maria's share



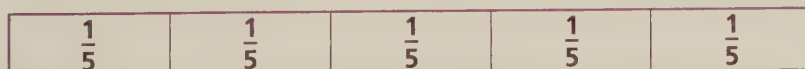
$$\frac{5}{5} = \frac{1}{5} + \frac{1}{5}$$



$$\frac{5}{5} = \frac{1}{5} + \frac{1}{5}$$



$$\frac{5}{5} = \frac{1}{5} + \frac{1}{5}$$



$$\frac{5}{5} = \frac{1}{5} + \frac{1}{5}$$

Sixths that Add to One

The librarian put 6 equal piles of returned books on the cart for Liu and Henry to reshelve. They also drew fraction bars.

- 2 On each sixths bar, circle two groups of sixths to show one way that Liu and Henry could share the work. (Each bar should show a different possibility.) Then complete the equation next to each bar to show their shares.

1 whole = all of the books

1 whole Liu's share Henry's share



$$\frac{6}{6} = \frac{6}{6} + \frac{6}{6}$$



$$\frac{6}{6} = \frac{6}{6} + \frac{6}{6}$$



$$\frac{6}{6} = \frac{6}{6} + \frac{6}{6}$$



$$\frac{6}{6} = \frac{6}{6} + \frac{6}{6}$$



$$\frac{6}{6} = \frac{6}{6} + \frac{6}{6}$$

Find the Unknown Addend

Write the fraction that will complete each equation.

3 $1 = \frac{7}{7} = \frac{1}{7} + \underline{\hspace{2cm}}$

4 $1 = \frac{4}{4} = \frac{3}{4} + \underline{\hspace{2cm}}$

5 $1 = \frac{8}{8} = \frac{3}{8} + \underline{\hspace{2cm}}$

6 $1 = \frac{5}{5} = \frac{2}{5} + \underline{\hspace{2cm}}$

7 $1 = \frac{3}{3} = \frac{2}{3} + \underline{\hspace{2cm}}$

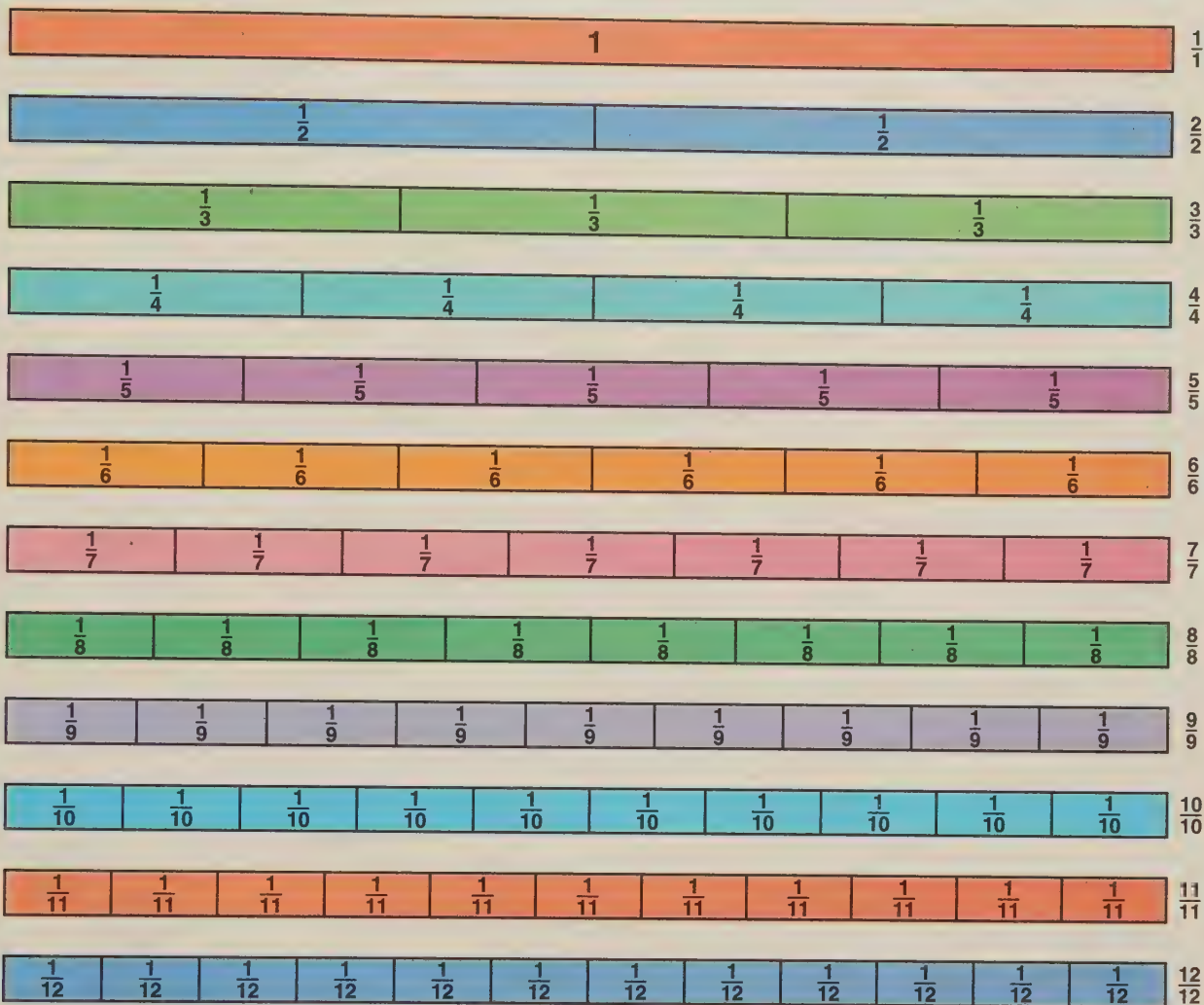
8 $1 = \frac{10}{10} = \frac{6}{10} + \underline{\hspace{2cm}}$

9 $1 = \frac{6}{6} = \frac{2}{6} + \underline{\hspace{2cm}}$

10 $1 = \frac{8}{8} = \frac{5}{8} + \underline{\hspace{2cm}}$

Discuss and Compare Unit Fractions

Use these fraction bars to help you compare the unit fractions. Write $>$ or $<$.



11 $\frac{1}{6} \bigcirc \frac{1}{8}$

12 $\frac{1}{5} \bigcirc \frac{1}{3}$

13 $\frac{1}{10} \bigcirc \frac{1}{12}$

14 $\frac{1}{7} \bigcirc \frac{1}{4}$

15 $\frac{1}{9} \bigcirc \frac{1}{12}$

16 $\frac{1}{9} \bigcirc \frac{1}{11}$

17 Complete this statement:

When comparing two unit fractions, the fraction
with the smaller denominator is _____.

Compare and Order Unit Fractions

Write the unit fractions in order from least to greatest.

18 $\frac{1}{6}, \frac{1}{8}, \frac{1}{5}$

19 $\frac{1}{11}, \frac{1}{4}, \frac{1}{8}$

20 $\frac{1}{3}, \frac{1}{10}, \frac{1}{7}$

Solve.

- 21 Andi and Paolo both ordered small pizzas. Andi ate $\frac{1}{4}$ of her pizza. Paolo ate $\frac{1}{6}$ of his pizza. Who ate more pizza?

- 22 Elena ordered a small pizza. Max ordered a large pizza. Elena ate $\frac{1}{3}$ of her pizza. Max ate $\frac{1}{4}$ of his pizza. Elena said she ate more pizza because $\frac{1}{3} > \frac{1}{4}$. Do you agree? Explain.

What's the Error?

Dear Math Students,

I had to compare $\frac{1}{4}$ and $\frac{1}{2}$ on my math homework. I reasoned that $\frac{1}{4}$ is greater than $\frac{1}{2}$ because 4 is greater than 2. My friend told me this isn't right. Can you help me understand why my reasoning is wrong?

Your friend,
Puzzled Penguin



- 23 Write a response to Puzzled Penguin.

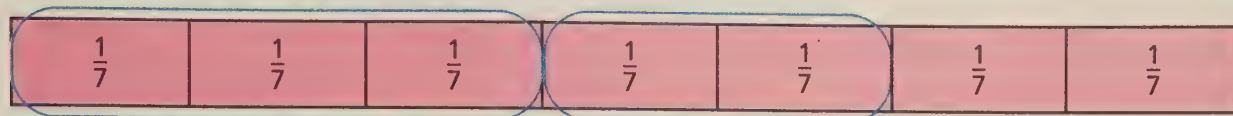
Check Understanding

Explain how to find pairs of fractions that have a sum of $\frac{5}{5}$.



Add Fractions

The circled parts of this fraction bar show an addition problem.



- 1 Complete this addition equation to match the problem above.

$$\frac{1}{7} + \frac{1}{7} = \frac{\quad}{7} = \frac{\quad}{7}$$

Write the numerators to complete each addition equation.

2 $\frac{3}{9} + \frac{4}{9} = \frac{\quad}{9} = \frac{\quad}{9}$

3 $\frac{1}{5} + \frac{3}{5} = \frac{\quad}{5} = \frac{\quad}{5}$

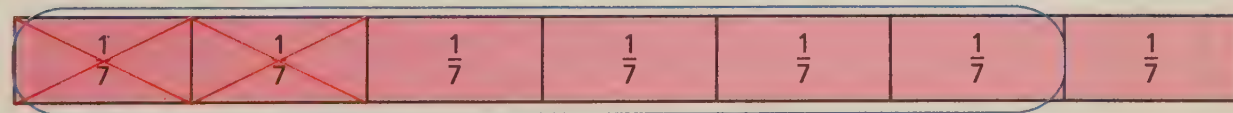
4 $\frac{2}{8} + \frac{5}{8} = \frac{\quad}{8} = \frac{\quad}{8}$

- 5 What happens to the numerators in each equation?

- 6 What happens to the denominators in each equation?

Subtract Fractions

The circled and crossed-out parts of this fraction bar show a subtraction problem.



- 7 Write the numerators to complete the subtraction equation.

$$\frac{1}{7} - \frac{1}{7} = \frac{\quad}{7} = \frac{\quad}{7}$$

Subtract Fractions (continued)

Write the numerators to complete each subtraction equation.

$$\textcircled{8} \frac{5}{6} - \frac{4}{6} = \frac{\quad}{6} = \frac{\quad}{6} \quad \textcircled{9} \frac{9}{10} - \frac{5}{10} = \frac{\quad}{10} = \quad \quad \textcircled{10} \frac{14}{16} - \frac{9}{16} = \frac{\quad}{16} = \quad$$

$\textcircled{11}$ What happens to the numerators in each equation?

$\textcircled{12}$ How is subtracting fractions with like denominators similar to adding fractions with like denominators?

Mixed Practice with Addition and Subtraction

Solve each problem. Include the “circled” step in Exercises 16–21.

$$\textcircled{13} \frac{1}{4} + \frac{2}{4} = \frac{\textcircled{+}}{4} =$$

$$\textcircled{14} \frac{3}{9} + \frac{5}{9} = \frac{\textcircled{+}}{9} =$$

$$\textcircled{15} \frac{6}{6} - \frac{2}{6} = \frac{\textcircled{-}}{6} =$$

$$\textcircled{16} \frac{4}{10} + \frac{5}{10} =$$

$$\textcircled{17} \frac{2}{5} + \frac{4}{5} =$$

$$\textcircled{18} \frac{8}{12} - \frac{3}{12} =$$

$$\textcircled{19} \frac{5}{7} + \frac{2}{7} =$$

$$\textcircled{20} \frac{7}{11} - \frac{4}{11} =$$

$$\textcircled{21} \frac{8}{8} - \frac{5}{8} =$$

Solve.

$$\textcircled{22} \begin{array}{r} \frac{7}{9} \\ - \frac{5}{9} \\ \hline \end{array}$$

$$\textcircled{23} \begin{array}{r} \frac{4}{5} \\ - \frac{3}{5} \\ \hline \end{array}$$

$$\textcircled{24} \begin{array}{r} \frac{1}{3} \\ + \frac{2}{3} \\ \hline \end{array}$$

$$\textcircled{25} \begin{array}{r} \frac{2}{11} \\ + \frac{7}{11} \\ \hline \end{array}$$

$$\textcircled{26} \begin{array}{r} \frac{5}{6} \\ - \frac{1}{6} \\ \hline \end{array}$$

$$\textcircled{27} \begin{array}{r} \frac{1}{8} \\ + \frac{1}{8} \\ \hline \end{array}$$

What's the Error?

Dear Math Students,

My friend said, "If you catch 3 fish and then 2 more fish, how many fish will you have?"
Of course, I know I will have 5 fish! She said, "This is the same problem, but you have fifths instead of fish!"

$$\frac{3}{5} + \frac{2}{5} = \frac{5}{10}$$



Can you help me understand what my friend meant and help me find the right answer?

Your friend,
Puzzled Penguin

28 Write a response to Puzzled Penguin.

Dear Math Students,

My friend said my answer for this problem is wrong too.

She said, "Think about fish again. If you have 4 fish and then eat 3, how many will you have?" What does she mean? What should the answer be?

$$\frac{4}{5} - \frac{3}{5} = \frac{1}{0}$$



Your friend,
Puzzled Penguin

29 Write a response to Puzzled Penguin.

Real World Problems

Draw a model. Then solve.

- 30 Wayne had $\frac{7}{8}$ cup of trail mix. He ate $\frac{3}{8}$ cup as he was hiking. How many cups does he have now?
-

- 31 Reese had $\frac{2}{4}$ cup of orange juice. She added pineapple juice to make a total of $\frac{3}{4}$ cup of juice. How much pineapple juice did she add?
-

Write an equation. Then solve.

Show your work.

- 32 Nasira walks $\frac{4}{5}$ mile to school each day. This is $\frac{2}{5}$ mile farther than Kat walks. How far does Kat walk to school?
-

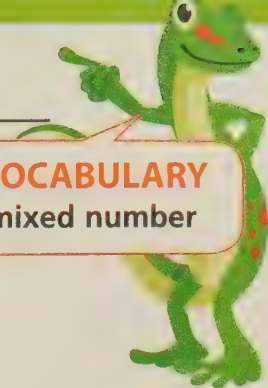
- 33 A puppy is now 5 weeks old. It has gained $\frac{8}{16}$ pound since it was born. The puppy weighs $\frac{11}{16}$ pound now. How much did the puppy weigh when it was born?
-

- 34 The water in a tub was $\frac{7}{12}$ foot deep. Then Dom added water until it was $\frac{4}{12}$ foot deeper. How deep is the water now?
-



Check Understanding

Circle the correct answer that completes the sentence.
When you add or subtract fractions with like denominators, the unit *does/does not* change.



Mixed Numbers in the Real World

A **mixed number** is a number that consists of a whole number and a fraction.

$$1\frac{4}{6} \quad 3\frac{4}{5}$$

A fraction greater than 1 has a numerator greater than its denominator.

$$\frac{10}{6} \quad \frac{19}{5}$$

Mellie's Deli makes sandwiches. This is the price list.

Mellie's Deli	
Regular (serves 2).....	\$3.00
Friendship (serves 4).....	\$5.00
Super (serves 10).....	\$12.00
Magna (serves 18).....	\$20.00



Nineteen friends decide to buy lunch for their camping trip. They order two Super sandwiches. Each camper eats 1 serving.

Solve.

- 1 How many campers does one Super sandwich serve?

- 2 What fraction of the second sandwich is needed to serve the rest of the campers?

- 3 What fraction of the second sandwich is left over?

- 4 What number tells how many Super sandwiches the campers ate in all?

Convert Between Mixed Numbers and Fractions Greater Than 1

Change each mixed number to a fraction and each fraction to a mixed number.

5 $5\frac{2}{3} =$ _____

6 $3\frac{3}{7} =$ _____

7 $6\frac{6}{10} =$ _____

8 $9\frac{1}{4} =$ _____

9 $2\frac{7}{8} =$ _____

10 $4\frac{5}{9} =$ _____

11 $8\frac{3}{5} =$ _____

12 $7\frac{4}{6} =$ _____

13 $\frac{40}{6} =$ _____

14 $\frac{11}{2} =$ _____

15 $\frac{23}{7} =$ _____

16 $\frac{28}{3} =$ _____

17 $\frac{22}{4} =$ _____

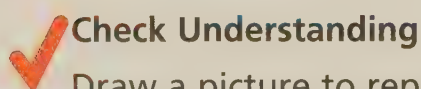
18 $\frac{25}{8} =$ _____

19 $\frac{29}{7} =$ _____

20 $6\frac{4}{8} =$ _____

21 $4\frac{6}{9} =$ _____

22 $\frac{16}{3} =$ _____



Check Understanding

Draw a picture to represent the mixed number for Exercise 17.

Understand Fractions Greater Than 1 and Mixed Numbers

1 whole



$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$
$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{1}{8}$



$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$
$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$
$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$
$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$
$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$
$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$
$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$	$\frac{1}{5}$

Understand Fractions Greater Than 1 and Mixed Numbers (continued)

1 whole

1 whole
1 whole
1 whole
1 whole
1 whole
1 whole
1 whole

1 whole
1 whole
1 whole
1 whole
1 whole
1 whole
1 whole



Practice Addition and Subtraction with Fractions Greater Than 1

Add or subtract.

$$1 \quad \frac{8}{5} + \frac{3}{5} = \underline{\hspace{2cm}}$$

$$2 \quad \frac{6}{9} + \frac{12}{9} = \underline{\hspace{2cm}}$$

$$3 \quad \frac{10}{7} - \frac{3}{7} = \underline{\hspace{2cm}}$$

$$4 \quad \frac{10}{8} + \frac{7}{8} = \underline{\hspace{2cm}}$$

$$5 \quad \frac{9}{6} - \frac{4}{6} = \underline{\hspace{2cm}}$$

$$6 \quad \frac{19}{10} - \frac{7}{10} = \underline{\hspace{2cm}}$$

Add Mixed Numbers with Like Denominators

Add.

$$7 \quad \begin{array}{r} 2\frac{3}{5} \\ + 1\frac{1}{5} \\ \hline \end{array}$$

$$8 \quad \begin{array}{r} 1\frac{2}{5} \\ + 3\frac{4}{5} \\ \hline \end{array}$$

$$9 \quad \begin{array}{r} 3\frac{5}{8} \\ + 1\frac{3}{8} \\ \hline \end{array}$$

$$10 \quad \begin{array}{r} 5\frac{2}{3} \\ + 2\frac{2}{3} \\ \hline \end{array}$$

Subtract Mixed Numbers with Like Denominators

Subtract.

$$11 \quad \begin{array}{r} 5\frac{6}{8} \\ - 3\frac{3}{8} \\ \hline \end{array}$$

$$12 \quad \begin{array}{r} 6\frac{2}{8} \\ - 4\frac{5}{8} \\ \hline \end{array}$$

$$13 \quad \begin{array}{r} 4\frac{1}{5} \\ - 1\frac{3}{5} \\ \hline \end{array}$$

$$14 \quad \begin{array}{r} 5\frac{1}{6} \\ - 3\frac{4}{6} \\ \hline \end{array}$$

Explain each solution.

$$15 \quad \begin{array}{r} 5\cancel{6}\frac{7+2=9}{7} = 5\frac{9}{7} \\ - 1\frac{5}{7} = 1\frac{5}{7} \\ \hline 4\frac{4}{7} \end{array}$$

$$16 \quad \begin{array}{r} 5\cancel{6}\frac{6+2=8}{6} = 5\frac{8}{6} \\ - 1\frac{5}{6} = 1\frac{5}{6} \\ \hline 4\frac{3}{6} \end{array}$$

$$17 \quad \begin{array}{r} 5\cancel{6}\frac{11+2=13}{11} = 5\frac{13}{11} \\ - 1\frac{5}{11} = 1\frac{5}{11} \\ \hline 4\frac{8}{11} \end{array}$$

What's the Error?

Dear Math Students,

Here is a subtraction problem that I tried to solve.

Is my answer correct? If not, please help me understand why it is wrong.

Your friend,
Puzzled Penguin

$$\begin{array}{r} 7\frac{3}{8} \\ - 1\frac{5}{8} \\ \hline 6\frac{2}{8} \end{array}$$



- 18** Write a response to Puzzled Penguin.

Compare and Subtract

Compare each pair of mixed numbers using $>$ or $<$. Then subtract the lesser mixed number from the greater mixed number.

19 $3\frac{2}{5}$; $1\frac{4}{5}$ _____

20 $1\frac{8}{9}$; $2\frac{2}{9}$ _____

21 $1\frac{3}{11}$; $1\frac{6}{11}$ _____

22 $4\frac{1}{8}$; $2\frac{7}{8}$ _____

23 $3\frac{2}{6}$; $4\frac{3}{6}$ _____

24 $10\frac{1}{3}$; $7\frac{2}{3}$ _____

✓ Check Understanding

Represent your solution to Exercise 22 by drawing fraction bars.



Practice with Fractions and Mixed Numbers

Write the fraction that will complete each equation.

1 $1 = \frac{4}{4} = \frac{1}{4} + \underline{\hspace{2cm}}$

2 $1 = \frac{10}{10} = \frac{9}{10} + \underline{\hspace{2cm}}$

3 $1 = \frac{8}{8} = \frac{4}{8} + \underline{\hspace{2cm}}$

Write each fraction as a sum of fractions in two different ways.

4 $\frac{5}{6} \underline{\hspace{2cm}}$

5 $\frac{8}{10} \underline{\hspace{2cm}}$

6 $\frac{6}{8} \underline{\hspace{2cm}}$

7 $\frac{10}{6} \underline{\hspace{2cm}}$

Write each fraction as a mixed number.

8 $\frac{11}{8} = \underline{\hspace{2cm}}$

9 $\frac{15}{6} = \underline{\hspace{2cm}}$

10 $\frac{32}{5} = \underline{\hspace{2cm}}$

Write each mixed number as a fraction.

11 $3\frac{2}{5} = \underline{\hspace{2cm}}$

12 $1\frac{1}{4} = \underline{\hspace{2cm}}$

13 $2\frac{11}{12} = \underline{\hspace{2cm}}$

Add or subtract.

14 $\frac{2}{5} + \frac{1}{5} = \underline{\hspace{2cm}}$

15 $\frac{3}{9} + \frac{6}{9} = \underline{\hspace{2cm}}$

16 $\frac{4}{6} - \frac{3}{6} = \underline{\hspace{2cm}}$

17 $\frac{5}{7} - \frac{2}{7} = \underline{\hspace{2cm}}$

18 $\frac{7}{12} + \frac{1}{12} = \underline{\hspace{2cm}}$

19 $\frac{10}{10} - \frac{4}{10} = \underline{\hspace{2cm}}$

20 $\frac{9}{4} + \frac{5}{4} = \underline{\hspace{2cm}}$

21 $\frac{23}{8} - \frac{12}{8} = \underline{\hspace{2cm}}$

22 $\frac{5}{2} + \frac{3}{2} = \underline{\hspace{2cm}}$

Practice with Fractions and Mixed Numbers (continued)

Add or subtract.

$$\begin{array}{r} 23 \quad 3\frac{1}{4} \\ + 5\frac{2}{4} \\ \hline \end{array}$$

$$\begin{array}{r} 24 \quad 4\frac{6}{8} \\ - 3\frac{3}{8} \\ \hline \end{array}$$

$$\begin{array}{r} 25 \quad 1\frac{3}{5} \\ + 1\frac{2}{5} \\ \hline \end{array}$$

$$\begin{array}{r} 26 \quad 4\frac{1}{3} \\ - 1\frac{2}{3} \\ \hline \end{array}$$

$$\begin{array}{r} 27 \quad 2\frac{5}{10} \\ + 4\frac{9}{10} \\ \hline \end{array}$$

$$\begin{array}{r} 28 \quad 10\frac{5}{8} \\ - 3\frac{7}{8} \\ \hline \end{array}$$

What's the Error?

Dear Math Students,

This is a problem from my math homework.
My friend says my answer is not correct,
but I can't figure out what I did wrong.
Can you help me find and fix my mistake?

Your friend,
Puzzled Penguin

$$\begin{array}{r} 4\frac{9}{8} \\ 4\frac{1}{8} \\ - 1\frac{5}{8} \\ \hline 3\frac{4}{8} \end{array}$$



29 Write a response to Puzzled Penguin.

Real World Problems

Write an equation. Then solve.

Show your work.

- 30 Daniel spent $1\frac{1}{4}$ hours playing soccer on Saturday and $\frac{3}{4}$ hour playing soccer on Sunday. How much time did he spend playing soccer over the weekend?
- _____

- 31 A pitcher contains $4\frac{3}{8}$ cups of juice. Antonio pours $\frac{5}{8}$ cup into a glass. How much juice is left in the pitcher?
- _____

- 32 Shayna walked from school to the library. Then she walked $1\frac{3}{10}$ miles from the library to her apartment. If she walked $2\frac{1}{10}$ miles in all, how far did she walk from school to the library?
- _____

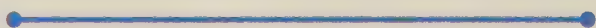
- 33 The vet said Lucy's cat Mittens weighs $7\frac{1}{4}$ pounds. This is $1\frac{2}{4}$ pounds more than Mittens weighed last year. How much did Mittens weigh last year?
- _____

- 34 The width of a rectangle is $3\frac{5}{6}$ inches. The length of the rectangle is $1\frac{4}{6}$ inches longer than the width. What is the length of the rectangle?
- _____

- 35 Choose one of the problems on this page. Draw a model to show that your answer is correct.

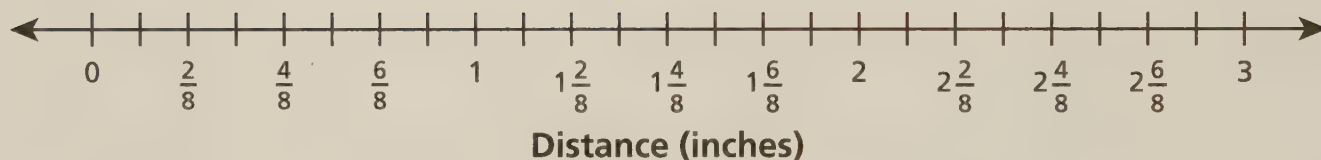
Make a Line Plot

- 36 Make a mark anywhere on this line segment.



- 37 Measure the distance from the left end of the segment to your mark to the nearest $\frac{1}{8}$ inch.

- 38 Collect measurements from your classmates and record them in the line plot below.



- 39 The range is the difference between the greatest value and the least value. What is the range of the data?

- 40 Which distance value occurred most often?

✓ Check Understanding

For your line plot in Problem 38, suppose the greatest value is $1\frac{4}{8}$ and the least value is $\frac{6}{8}$. What is the range of the data?



A Whole Number Multiplied by a Unit Fraction

The lunchroom at Mandy's school serves pizza every Friday. Each slice is $\frac{1}{4}$ of a pizza. Mandy eats one slice every week.

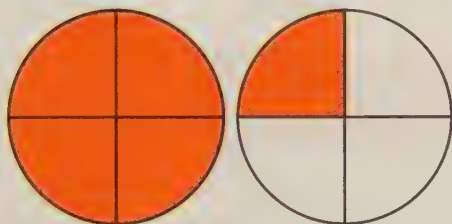


To find the fraction of a pizza she eats in three weeks, you can add or multiply.

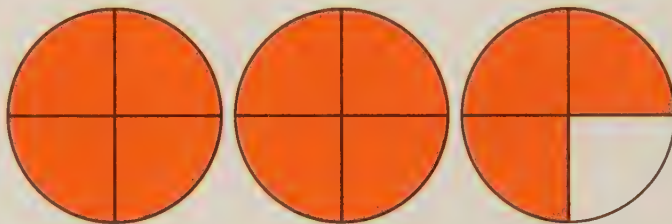
$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4} \quad \text{or} \quad 3 \cdot \frac{1}{4} = \frac{3}{4}$$

Solve each problem, first by adding and then by multiplying.
Show your work.

- 1 What fraction of a pizza does she eat in five weeks?



- 2 What fraction of a pizza does she eat in eleven weeks?



Draw a model for each problem. Then solve.

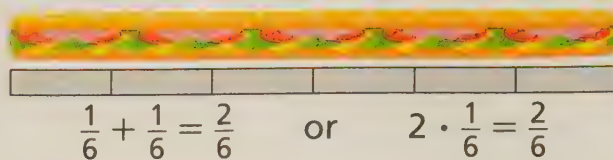
3 $2 \cdot \frac{1}{3} =$ _____ 4 $6 \cdot \frac{1}{5} =$ _____ 5 $10 \cdot \frac{1}{8} =$ _____

Draw a model for each fraction. Then write each fraction as the product of a whole number and a unit fraction.

6 $\frac{3}{5} =$ _____ $\cdot \frac{1}{5}$ 7 $\frac{8}{3} =$ _____ $\cdot$ _____ 8 $\frac{12}{7} =$ _____ $\cdot$ _____

A Whole Number Multiplied by a Non-Unit Fraction

The lunchroom at Joe's school serves sub sandwiches every Thursday. Each slice is $\frac{1}{6}$ of a sub. Joe eats two pieces, or $\frac{2}{6}$ of a sandwich, every week.



Solve each problem, first by adding and then by multiplying. Write your answer as a fraction.
Show your work.

- 9 What fraction of a sandwich does Joe eat in three weeks?



- 10 What fraction of a sandwich does Joe eat in five weeks?



Draw a model for each problem. Then solve.

11 $4 \cdot \frac{3}{8} =$ _____

12 $2 \cdot \frac{4}{5} =$ _____

13 $5 \cdot \frac{2}{3} =$ _____

Solve. Write your answer as a fraction.

14 $8 \cdot \frac{3}{4} =$ _____

15 $18 \cdot \frac{2}{3} =$ _____

16 $10 \cdot \frac{5}{6} =$ _____

17 $4 \cdot \frac{5}{7} =$ _____

18 $15 \cdot \frac{3}{10} =$ _____

19 $7 \cdot \frac{8}{9} =$ _____

Real World Problems

Draw a model for each problem. Then solve.

- 20 The five members of the Sanchez family each drank $\frac{3}{4}$ cup orange juice for breakfast. How much juice did the family drink for breakfast altogether? _____

- 21 Stella ran $\frac{1}{2}$ mile. Brian ran 7 times as far as Stella.

How far did Brian run? _____

Write an equation. Then solve.

Show your work.

- 22 A banner has a length of 3 yards and a width of $\frac{2}{3}$ yard. What is the area of the banner?

- 23 The 12 members of a volleyball team had a pizza party. Each pizza was divided into 8 equal slices and each player ate 3 slices. How many pizzas did the team eat altogether?

- 24 It took Eli's mother $\frac{1}{6}$ hour to drive him to school. It took Alex 4 times as long as this to walk to school. How long did it take Alex to walk to school?

Real World Problems (continued)

Write an equation. Then solve.

Show your work.

- 25** Ami has building bricks that are $\frac{5}{8}$ inch thick. She makes a stack of 15 bricks. How tall is the stack?
-

- 26** A crepe recipe calls for $\frac{3}{4}$ cup of flour. A bread recipe calls for four times this much flour. How much flour is in the bread recipe?
-

What's the Error?

Dear Math Students,

I have so much homework! I have assignments in math, science, and reading. I think each subject will take $\frac{1}{2}$ hour. I tried to multiply to find the total time.

$$3 \cdot \frac{1}{2} = \frac{3}{6}$$

That can't be right! I know $\frac{3}{6}$ is the same as $\frac{1}{2}$ so that is only $\frac{1}{2}$ hour.

What did I do wrong? How long will my homework really take?

Your friend,
Puzzled Penguin



- 27** Write a response to Puzzled Penguin.
-
-

✓ Check Understanding

Draw a picture to show that $5 \cdot \frac{7}{12} = \frac{35}{12}$.



Multiplication Practice

Write each fraction as a sum of unit fractions and as the product of a whole number and a unit fraction.

$$1 \quad \frac{4}{7} = \underline{\hspace{2cm}}$$

$$\frac{4}{7} = \underline{\hspace{2cm}}$$

$$2 \quad \frac{5}{2} = \underline{\hspace{2cm}}$$

$$\frac{5}{2} = \underline{\hspace{2cm}}$$

$$3 \quad \frac{2}{3} = \underline{\hspace{2cm}}$$

$$\frac{2}{3} = \underline{\hspace{2cm}}$$

$$4 \quad \frac{6}{4} = \underline{\hspace{2cm}}$$

$$\frac{6}{4} = \underline{\hspace{2cm}}$$

Draw a model for each problem. Then solve.

$$5 \quad 6 \cdot \frac{1}{4} = \underline{\hspace{2cm}}$$

$$6 \quad 6 \cdot \frac{2}{3} = \underline{\hspace{2cm}}$$

$$7 \quad 3 \cdot \frac{2}{9} = \underline{\hspace{2cm}}$$

$$8 \quad 4 \cdot \frac{4}{5} = \underline{\hspace{2cm}}$$

Multiply. Write your answer as a mixed number or a whole number, when possible.

$$9 \quad 20 \cdot \frac{3}{10} = \underline{\hspace{2cm}}$$

$$10 \quad 36 \cdot \frac{5}{9} = \underline{\hspace{2cm}}$$

$$11 \quad 2 \cdot \frac{2}{12} = \underline{\hspace{2cm}}$$

$$12 \quad 21 \cdot \frac{1}{3} = \underline{\hspace{2cm}}$$

$$13 \quad 16 \cdot \frac{3}{8} = \underline{\hspace{2cm}}$$

$$14 \quad 11 \cdot \frac{7}{10} = \underline{\hspace{2cm}}$$

Real World Problems*Show your work.*

Draw a model for each problem. Then solve. Write your answer as a mixed number or a whole number, when possible.

- 15** Michelle has three textbooks. Each weighs $\frac{5}{8}$ pound. What is the total weight of her textbooks?
-

- 16** Mark lived in a house in the suburbs with $\frac{2}{3}$ acre of land. Then he moved to a farm in the country that has 6 times as much land. How much land is on Mark's farm?
-

Write an equation. Then solve. Write your answer as a mixed number or a whole number, when possible.

- 17** A restaurant served quiche for lunch today. Each quiche was cut into six equal pieces. The restaurant sold 59 pieces. How many quiches is this?
-

- 18** Zahra's dog Brutus weighed $\frac{7}{8}$ pound when he was born. Now he weighs 60 times as much. How much does Brutus weigh now?
-

- 19** Calvin made posters to advertise the school play. Each poster is 2 feet long and $\frac{11}{12}$ foot wide. What is the area of each poster?
-

 Check Understanding

Explain why the denominator does not change when you multiply a fraction by a whole number.



Practice Fraction Operations

Write each fraction as a sum of fractions in two different ways.

1 $\frac{3}{10} =$ _____

2 $\frac{7}{7} =$ _____

3 $\frac{4}{5} =$ _____

4 $\frac{5}{12} =$ _____

Add or subtract.

5 $\frac{5}{8} + \frac{3}{8} =$ _____

6 $\frac{2}{10} + \frac{1}{10} =$ _____

7 $\frac{7}{9} - \frac{3}{9} =$ _____

8
$$\begin{array}{r} 6\frac{7}{10} \\ - 1\frac{4}{10} \\ \hline \end{array}$$

9
$$\begin{array}{r} 5\frac{2}{3} \\ + 4\frac{1}{3} \\ \hline \end{array}$$

10
$$\begin{array}{r} 7\frac{1}{6} \\ - 3\frac{2}{6} \\ \hline \end{array}$$

11
$$\begin{array}{r} 12\frac{4}{9} \\ + 10\frac{5}{9} \\ \hline \end{array}$$

12
$$\begin{array}{r} 1\frac{4}{5} \\ + 1\frac{3}{5} \\ \hline \end{array}$$

13
$$\begin{array}{r} 7 \\ - 1\frac{1}{4} \\ \hline \end{array}$$

Multiply. Write your answer as a mixed number or a whole number, when possible.

14 $7 \cdot \frac{1}{10} =$ _____

15 $4 \cdot \frac{2}{9} =$ _____

16 $5 \cdot \frac{3}{5} =$ _____

17 $12 \cdot \frac{3}{4} =$ _____

18 $7 \cdot \frac{5}{8} =$ _____

19 $10 \cdot \frac{5}{6} =$ _____

Real World Problems

Write an equation. Then solve.

Show your work.

- 20** Dimitri rode his bike 32 miles yesterday. He rode $12\frac{4}{5}$ miles before lunch and the rest of the distance after lunch. How far did he ride after lunch?
-
- 21** Ms. Washington is taking an accounting class. Each class is $\frac{3}{4}$ hour long. If there are 22 classes in all, how many hours will Ms. Washington spend in class?
-
- 22** Elin bought a large watermelon at the farmers market. She cut off a $5\frac{5}{8}$ -pound piece and gave it to her neighbor. She has $11\frac{5}{8}$ pounds of watermelon left. How much did the whole watermelon weigh?
-
- 23** A bread recipe calls for $\frac{3}{4}$ cup of whole wheat flour, $1\frac{2}{4}$ cups of white flour, and $\frac{3}{4}$ cup of rye flour. How much flour is this in all?
-
- 24** Henri spent a total of $3\frac{2}{6}$ hours working on his science project. Kali spent $1\frac{5}{6}$ hours working on her science project. How much longer did Henri work on his project?
-
- 25** A track is $\frac{1}{4}$ mile long. Kenny ran around the track 21 times. How far did Kenny run in all?
-

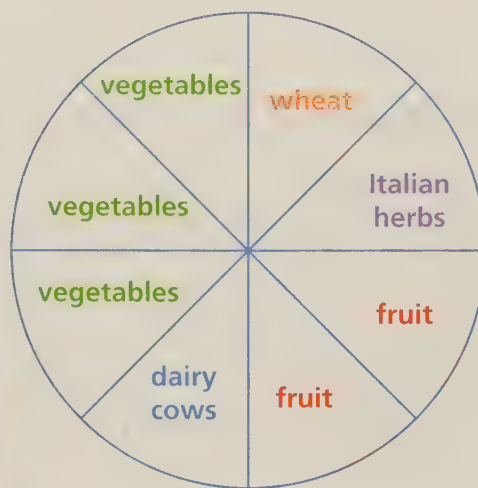
Check Understanding

Which problem above could you ungroup a whole number to find the difference?



Math and Vegetarian Pizza Farms

A pizza farm is a circular region of land divided into eight pie-shaped wedges or slices, such as those you would see in a pizza. At a vegetarian pizza farm, each wedge or slice grows a different vegetarian ingredient used to make a pizza. Some things you might find on a vegetarian pizza farm include wheat, fruit, vegetables, Italian herbs, and dairy cows to make cheese.



Write an equation to solve.

Show your work.

A farmer created a vegetarian pizza farm with these wedges or slices: $\frac{3}{8}$ for vegetables, $\frac{1}{8}$ for wheat, $\frac{2}{8}$ for fruit, $\frac{1}{8}$ for dairy cows, and $\frac{1}{8}$ for Italian herbs.

- 1 What fraction of the farm is made up of fruit or vegetables?

- 2 What fraction of the farm is *not* made up of wheat?

- 3 Which wedge of the farm is bigger, the wedge for fruit or the wedge for Italian herbs? Explain.

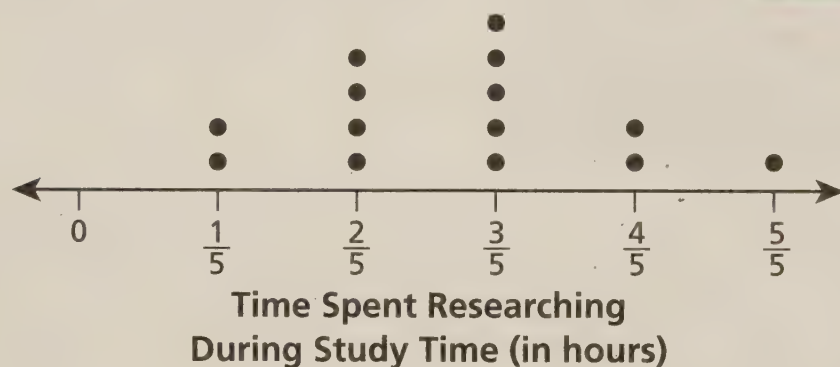
Write an equation to solve.

Show your work.

- 4 On Monday, two of the workers at the pizza farm each filled a basket with ripe tomatoes. Miles picked $15\frac{1}{6}$ pounds of tomatoes, and Anna picked $13\frac{5}{6}$ pounds of tomatoes. How many more pounds of tomatoes did Miles pick than Anna?
-

For Problems 5–6, use the line plot to solve.

After a field trip to a vegetarian pizza farm, Mrs. Cannon asked each of her students to use some of their study time to research different vegetarian ingredients for pizzas. The line plot below shows the amount of time each student spent researching during study time.



- 5 How many students spent at least $\frac{3}{5}$ hour researching? Explain how you know.
-
-

- 6 How many hours in all did the students who researched for $\frac{2}{5}$ hour spend researching? Write a multiplication equation to solve.
-

Multiply.

1 $10 \cdot \frac{2}{10} =$ _____

2 $13 \cdot \frac{5}{8} =$ _____

- 3 Liam has two trophies. The first trophy weighs $\frac{3}{8}$ pound. The second trophy weighs 3 times as much as the first trophy. How much does the second trophy weigh?
- _____

*Show your work.***Write an equation. Then solve.**

- 4 Cassie works on her art project $\frac{3}{4}$ hour every day for 12 days. How many hours does Cassie work on her project altogether?
- _____

- 5 At a petting zoo, $\frac{2}{12}$ of the animals are sheep and $\frac{5}{12}$ are goats. What fraction of the animals at the petting zoo are sheep or goats?
- _____

Add or subtract.

$$\begin{array}{r} 1 \quad 6,894 \\ - 3,421 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \quad 472 \\ - 368 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \quad 7,086 \\ - 4,825 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \quad 1,176 \\ + 483 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \quad 345 \\ + 314 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \quad 354,964 \\ - 46,379 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \quad 76,429 \\ + 6,850 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \quad 62,000 \\ - 51,752 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \quad 205,782 \\ - 178,935 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \quad 798 \\ - 340 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \quad 45,284 \\ - 8,451 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \quad 84,275 \\ + 17,682 \\ \hline \end{array}$$

$$\begin{array}{r} 13 \quad 725 \\ + 644 \\ \hline \end{array}$$

$$\begin{array}{r} 14 \quad 295,930 \\ + 357,392 \\ \hline \end{array}$$

$$\begin{array}{r} 15 \quad 8,312 \\ + 7,548 \\ \hline \end{array}$$

- 1 Represent the shaded part of the fraction bar as the product of a whole number and a unit fraction.

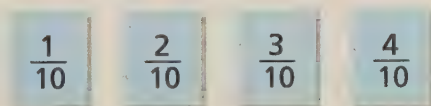


- 2 In the morning Naomi jumps rope for $\frac{1}{4}$ hour. After lunch she jumps rope for another $\frac{2}{4}$ hour. How long does Naomi jump rope? Write an equation. Then solve.

Equation: _____

Solution: _____ hour

- 3 For Exercises 3a–3d, write a fraction from the tiles to make a true equation.



3a. $\frac{10}{10} = \frac{5}{10} + \frac{3}{10} + \boxed{}$

3c. $\frac{7}{10} = \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \boxed{}$

3b. $1 = \frac{1}{10} + \frac{5}{10} + \boxed{}$

3d. $\frac{4}{10} = \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \boxed{}$

- 4 Caesar buys dog treats and cat treats. He buys $\frac{7}{8}$ pound of dog treats. This is $\frac{5}{8}$ pound more than the weight of the cat treats he buys. How many pounds of cat treats does Caesar buy? Write an equation. Then solve.

Equation: _____

Solution: _____ pound

- 5 A recipe calls for $\frac{2}{3}$ cup of mushrooms. Dae uses 3 times as many cups of mushrooms. Choose the number of cups of mushrooms he uses. Mark all that apply.

(A) $\frac{5}{3}$ cups

(C) 2 cups

(B) $\frac{6}{3}$ cups

(D) 3 cups

- 6 Complete the table to show the fraction as a product of a whole number and a unit fraction.

Fraction	Product
$\frac{5}{12}$	_____
$\frac{2}{3}$	_____
$\frac{4}{5}$	_____

- 7 For 7a–7d, choose the operation that makes the equation true.

7a. 6 $\begin{array}{|c|} \hline + \\ \hline - \\ \hline \times \\ \hline \end{array}$ $\frac{3}{4} = 4\frac{2}{4}$

7c. 4 $\begin{array}{|c|} \hline + \\ \hline - \\ \hline \times \\ \hline \end{array}$ $3\frac{3}{5} = 7\frac{3}{5}$

7b. 3 $\begin{array}{|c|} \hline + \\ \hline - \\ \hline \times \\ \hline \end{array}$ $\frac{2}{5} = 2\frac{3}{5}$

7d. 7 $\begin{array}{|c|} \hline + \\ \hline - \\ \hline \times \\ \hline \end{array}$ $\frac{1}{3} = 2\frac{1}{3}$

- 8 Multiply the expression to complete the table.

Expression	Written as a Fraction	Written as a Mixed Number
$7 \cdot \frac{1}{6}$	_____	_____
$12 \cdot \frac{1}{5}$	_____	$2\frac{2}{5}$
$3 \cdot \frac{5}{8}$	_____	_____

- 9 For Exercises 9a–9f, choose True or False for the equation.

9a. $\frac{2}{8} + \frac{1}{8} = \frac{3}{16}$ ☐ True ☐ False

9b. $\frac{4}{5} - \frac{1}{5} = \frac{3}{5}$ ☐ True ☐ False

9c. $\frac{9}{4} + \frac{2}{4} = 2\frac{3}{4}$ ☐ True ☐ False

9d. $\frac{5}{12} + \frac{4}{12} = \frac{9}{24}$ ☐ True ☐ False

9e. $8\frac{5}{6} - 6\frac{4}{6} = 2\frac{1}{6}$ ☐ True ☐ False

9f. $2\frac{7}{10} + 3\frac{3}{10} = 5\frac{10}{20}$ ☐ True ☐ False

- 10 Elias says this problem can be solved using addition. Vladimir says it can be solved using multiplication. Explain why both boys are correct.

Milo practices piano $\frac{3}{5}$ hour every day. How many hours does he practice in 5 days?

- 11** For 11a and 11b, find the sum or difference. Write your answer as a mixed number or a whole number, when possible.

11a.
$$\begin{array}{r} 5\frac{2}{3} \\ + 4\frac{2}{3} \\ \hline \end{array}$$

11b.
$$\begin{array}{r} 9\frac{3}{8} \\ - 3\frac{7}{8} \\ \hline \end{array}$$

- 12** On Saturday morning, Jesse plays basketball for $\frac{2}{3}$ hour. In the afternoon, he plays some more. He plays $2\frac{1}{3}$ hours in all. How long did Jesse play basketball in the afternoon?

Part A

Draw a model to represent the problem. Then solve. Explain how your model helps you solve the problem.

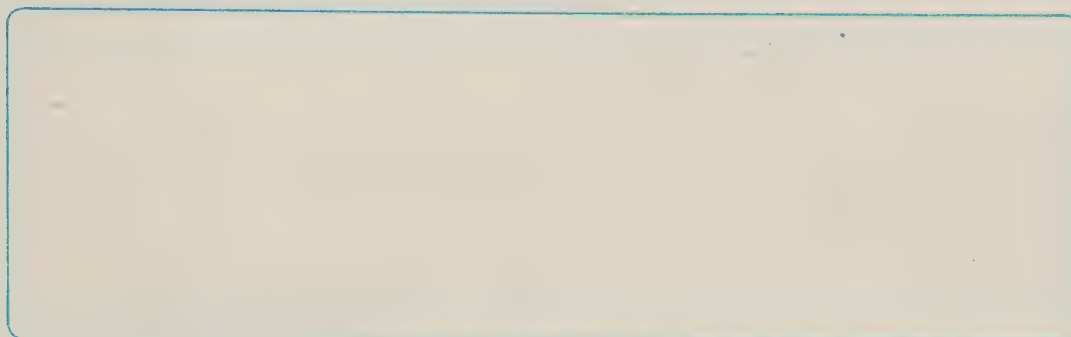
Part B

On Sunday, Jesse played basketball for $1\frac{2}{3}$ hours. How many total hours did he play basketball on Saturday and Sunday? Show your work.

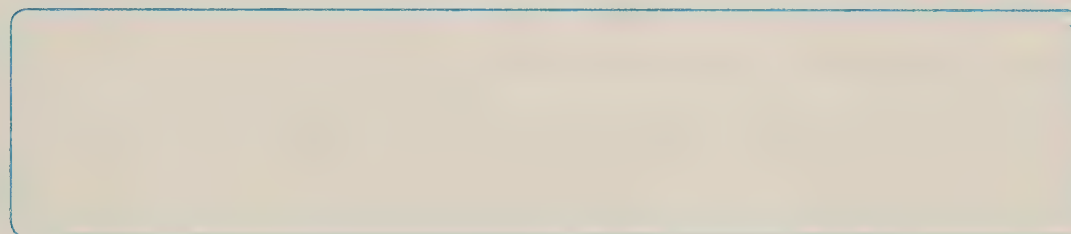
- 13 Rebecca's soup recipe calls for $\frac{3}{4}$ cup of milk. She needs 3 times as much milk to make a triple batch of soup. How many cups of milk does Rebecca need?

Part A

Draw a model for the problem.

**Part B**

Use your model to write two equations for the problem. Then solve.



- 14 For Exercises 14a–14e, choose Yes or No to tell whether the addition equation is true.

14a. $\frac{8}{10} = \frac{5}{10} + \frac{3}{10}$ ☐ Yes ☐ No

14b. $\frac{4}{5} = \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5} + \frac{1}{5}$ ☐ Yes ☐ No

14c. $\frac{6}{11} = \frac{4}{6} + \frac{2}{5}$ ☐ Yes ☐ No

14d. $\frac{3}{8} = \frac{1}{8} + \frac{1}{8} + \frac{1}{8}$ ☐ Yes ☐ No

14e. $\frac{10}{12} = \frac{5}{12} + \frac{5}{12}$ ☐ Yes ☐ No

- 15 The line plot shows the lengths of trails Andrea hiked last month at a state park.



Trail Lengths (miles)

Andrea hiked 3 miles last week. She could have hiked two $1\frac{1}{2}$ -mile trails. Describe two other combinations of trails she could have hiked.

- 16 Select the expression that is equivalent to $2\frac{2}{6}$. Mark all that apply.

(A) $\frac{1}{6} + \frac{1}{6} + \frac{2}{6}$

(D) $\frac{6}{6} + \frac{6}{6} + \frac{1}{6} + \frac{1}{6}$

(B) $1 + 1 + \frac{2}{6}$

(E) $\frac{20}{6} + \frac{2}{6}$

(C) $\frac{2}{6} + \frac{2}{6} + \frac{2}{6}$

(F) $\frac{6}{6} + \frac{3}{6} + \frac{3}{6} + \frac{2}{6}$

- 17 Explain how to change $\frac{11}{4}$ to a mixed number.

Mixing Paint

Mr. Myers stores paint in equal-size jars in his classroom. The table shows the amount of each color he has.

Mr. Myers's Paint						
Color	Red	Orange	Yellow	Blue	Green	Purple
Amount of Jar Filled	1	$\frac{1}{8}$	$1\frac{2}{8}$	$\frac{4}{8}$	$\frac{3}{8}$	$\frac{7}{8}$

- 1 Janet's project requires $\frac{5}{8}$ of a jar of orange paint. To make more orange, she needs to combine equal parts of red and yellow. How much of each color does she need?

- 2 How much red paint is left? How much yellow paint is left?

- 3 Three students need purple paint. Show how Mr. Myers can divide all of the paint into three jars. If he wants the three jars to contain an equal amount of paint, how much will be in each jar? How much will be left over?

- 4 Emilio's project used all the green paint in the jar, but his project is not finished. Mr. Myers thinks that Emilio needs 3 times as much green paint as he started with to finish. To make green, equal parts of yellow and blue can be combined. Does Mr. Myers have enough paint to make the amount of green paint Emilio needs? Explain why or why not.

- 5 Mr. Myers decides to buy green paint instead of making it. How many full jars of green paint does he need to buy? Explain.

- 6 At the end of the class, Mr. Meyers has $\frac{4}{8}$ jar of red paint and $\frac{5}{8}$ jar of yellow paint, and no orange paint. He finds $\frac{6}{8}$ of another jar of red paint in the closet. He wants to combine both jars of red paint to make one full jar and use any remaining red paint to mix with an equal amount of yellow paint to make more orange paint. How much red, yellow, and orange paint will he have? Explain how you solved the problem.

Dear Family:

In Lessons 1 through 7 of Unit 7 of *Math Expressions*, your child will build on previous experience with fractions. Your child will use both physical models and numerical methods to recognize and to find fractions equivalent to a given fraction. Your child will also compare and order fractions and mixed numbers, including those with like and unlike numerators and denominators.

By using fraction strips students determine how to model and compare fractions, and to find equivalent fractions. Your child will also learn how to use multiplication and division to find equivalent fractions.

Examples of Fraction Bar Modeling:

Fraction Comparisons



$$\frac{1}{3} < \frac{1}{2}$$

Equivalent Fractions



$$\frac{2}{8} = \frac{1}{4}$$

Your child will be introduced to the number-line model for fractions. Students name fractions corresponding to given lengths on the number line and identify lengths corresponding to given fractions. They also see that there are many equivalent fraction names for any given length.

Your child will apply this knowledge of fractions to word problems and in data displays.

If you have questions or problems, please contact me.

Thank you.

Sincerely,
Your child's teacher

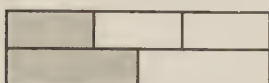
Estimada familia:

En las lecciones 1 a 7 de la Unidad 7 de *Math Expressions*, el niño ampliará sus conocimientos previos acerca de las fracciones. Su niño usará modelos físicos y métodos numéricos para reconocer y hallar fracciones equivalentes para una fracción dada. También comparará y ordenará fracciones y números mixtos, incluyendo aquellos que tengan numeradores y denominadores iguales o diferentes.

Usando tiras de fracciones, los estudiantes determinarán cómo hacer modelos y comparar fracciones y cómo hallar fracciones equivalentes. Además, aprenderán cómo usar la multiplicación y división para hallar fracciones equivalentes.

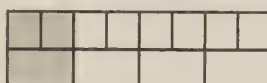
Ejemplos de modelos con barras de fracciones:

Comparar fracciones



$$\frac{1}{3} < \frac{1}{2}$$

Fracciones equivalentes



$$\frac{2}{8} = \frac{1}{4}$$

Su niño estudiará por primera vez el modelo de recta numérica para las fracciones. Los estudiantes nombrarán las fracciones que correspondan a determinadas longitudes en la recta numérica e identificarán longitudes que correspondan a fracciones dadas. También observarán que hay muchos nombres de fracciones equivalentes para una longitud determinada.

Su niño aplicará este conocimiento de las fracciones en problemas y en presentaciones de datos.

Si tiene alguna duda o algún comentario, por favor comuníquese conmigo.

Atentamente,
El maestro de su niño

**common
denominator**

hundredth

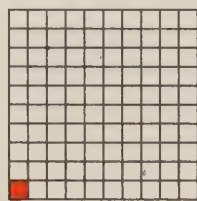
**decimal
number**

**simplify a
fraction**

**equivalent
fractions**

tenth

A unit fraction representing one of one hundred parts, written as 0.01 or $\frac{1}{100}$.



one hundredth = $\frac{1}{100} = 0.01$

7.634
↑
hundredth

A common multiple of two or more denominators.

Example:

A common denominator of $\frac{1}{2}$ and $\frac{1}{3}$ is 6 because 6 is a multiple of 2 and 3.

Dividing the numerator and the denominator of a fraction by the same number to make an equivalent fraction made from fewer but larger unit fractions.

Example:

$$\frac{5}{10} = \frac{5 \div 5}{10 \div 5} = \frac{1}{2}$$

A representation of a number using the numerals 0 to 9, in which each digit has a value 10 times the digit to its right. A dot or **decimal point** separates the whole-number part of the number on the left from the fractional part on the right.

Examples:

1.23 and 0.3

A unit fraction representing one of ten equal parts of a whole, written as 0.1 or $\frac{1}{10}$.



one tenth = $\frac{1}{10} = 0.1$

12.34
↑
tenth

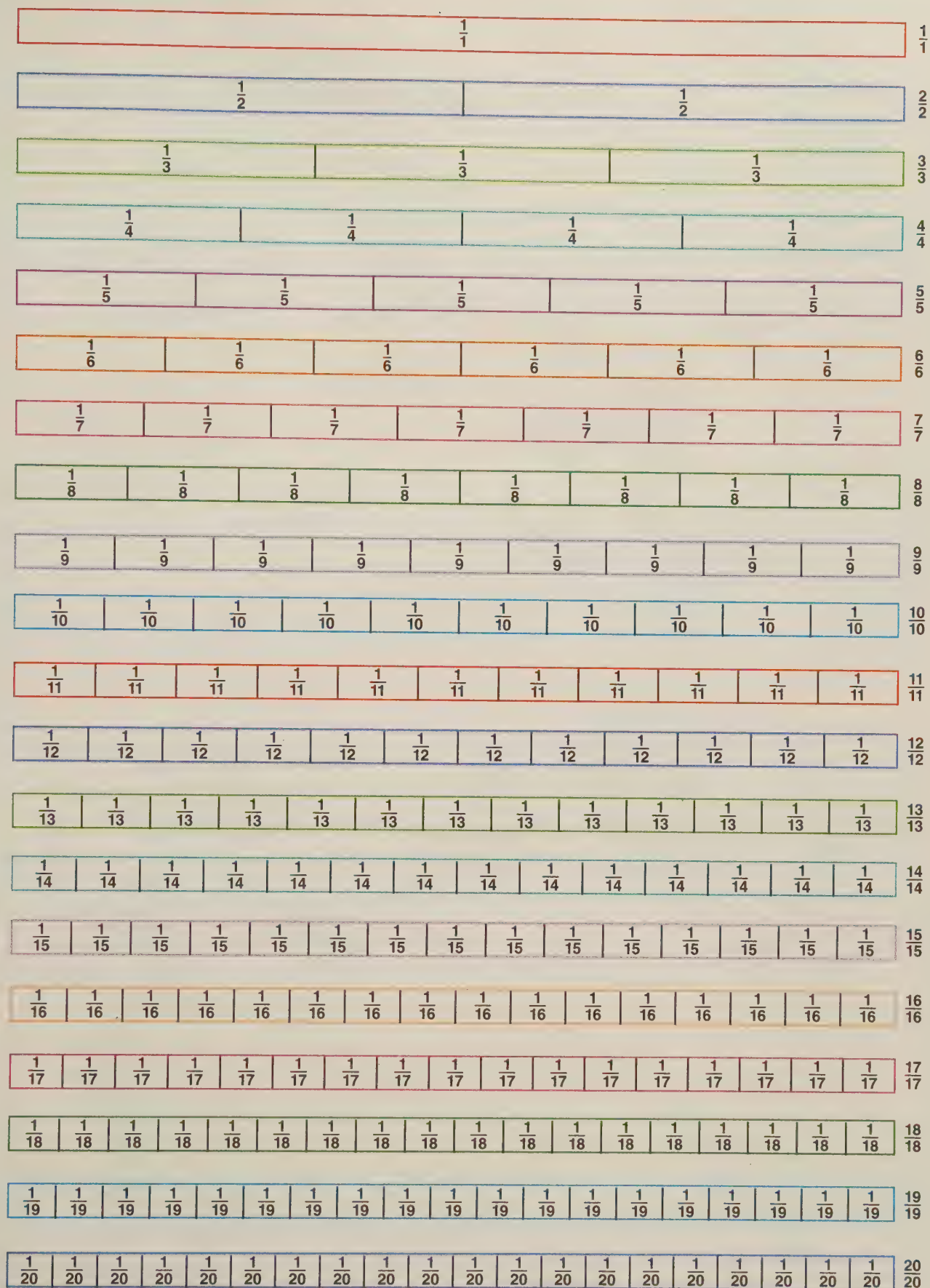
Two or more fractions that represent the same number.

Example:

$\frac{2}{4}$ and $\frac{4}{8}$ are equivalent because they both represent one half.

thousandth

A unit fraction representing one of one thousand equal parts of a whole, written as 0.001 or $\frac{1}{1,000}$.







Practice Comparing Fractions

Circle the greater fraction. Use fraction strips if you need to.

1 $\frac{1}{12}$ or $\frac{1}{2}$

2 $\frac{3}{8}$ or $\frac{1}{8}$

3 $\frac{2}{5}$ or $\frac{2}{6}$

4 $\frac{1}{3}$ or $\frac{1}{5}$

5 $\frac{4}{12}$ or $\frac{5}{12}$

6 $\frac{7}{10}$ or $\frac{5}{10}$

7 $\frac{1}{3}$ or $\frac{2}{3}$

8 $\frac{3}{6}$ or $\frac{3}{8}$

Write $>$ or $<$ to make each statement true.

9 $\frac{3}{10}$ $\frac{3}{8}$

10 $\frac{3}{6}$ $\frac{3}{5}$

11 $\frac{8}{10}$ $\frac{8}{12}$

12 $\frac{2}{6}$ $\frac{3}{6}$

13 $\frac{7}{10}$ $\frac{7}{8}$

14 $\frac{5}{100}$ $\frac{4}{100}$

What's the Error?

Dear Math Students,

Yesterday, my family caught a large fish. We ate $\frac{2}{6}$ of the fish.

Today, we ate $\frac{2}{4}$ of the fish. I told my mother that we ate more fish yesterday than today because 6 is greater than 4, so $\frac{2}{6}$ is greater than $\frac{2}{4}$. My mother told me I made a mistake. Can you help me to figure out what my mistake was?

Your friend,

Puzzled Penguin



15 Write a response to Puzzled Penguin.

Make Sense of Problems

- 16** Explain how to compare fractions with the same denominator but different numerators.

- 17** Explain how to compare fractions with the same numerator but different denominators.

Solve.

- 18** Bao listed the birds that visited his bird feeder Friday. He said that $\frac{2}{5}$ were finches and $\frac{2}{6}$ were wrens. Did more finches or more wrens visit the bird feeder? Explain.

- 19** Mariel had a box of baseball cards. She kept $\frac{3}{8}$ of the cards and gave $\frac{5}{8}$ of the cards to Javier. Who had more of the cards? Explain.

- 20** Write the fractions $\frac{10}{12}$, $\frac{5}{12}$, and $\frac{7}{12}$ in order from least to greatest.

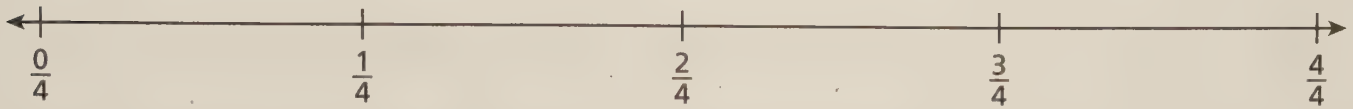
Check Understanding

Draw a diagram to support your solution to Problem 19.

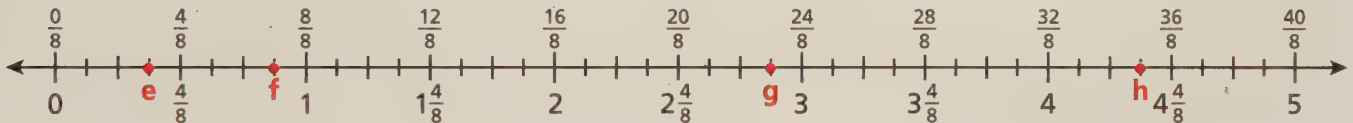
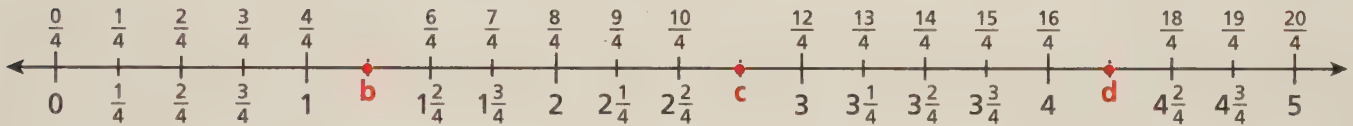
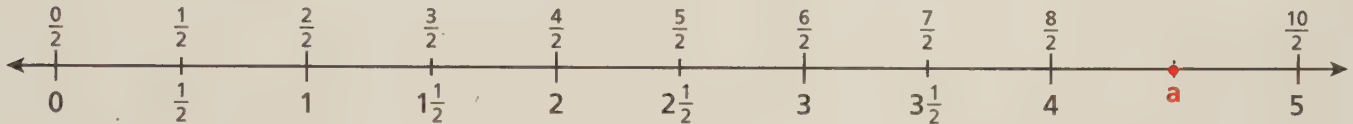


Discuss Number Lines

The number line below shows the fourths between 0 and 1. Discuss how the number line is like and unlike the fraction bar above it.



These number lines are divided to show different fractions.



Write $>$ or $<$ to make each statement true.

1 $\frac{3}{4}$ $\frac{5}{2}$

2 $\frac{15}{4}$ $\frac{20}{8}$

3 $\frac{10}{4}$ $\frac{24}{8}$

4 $2\frac{4}{8}$ $1\frac{3}{4}$

Identify Points

- 5 Write the fraction or mixed number for each lettered point on the number lines above.

a. _____

b. _____

c. _____

d. _____

e. _____

f. _____

g. _____

h. _____

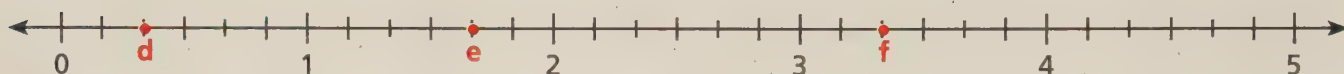
Number Lines for Thirds and Sixths

Tell how many equal parts are between 0 and 1.
Then write fraction labels above the equal parts.

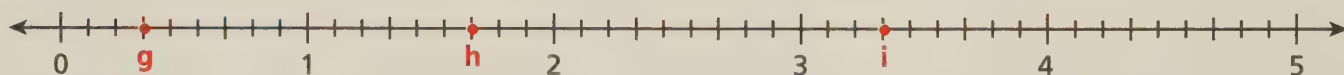
6 _____



7 _____



8 _____



Write $>$ or $<$ to make each statement true.

9 $\frac{4}{3}$ $\frac{7}{6}$

10 $\frac{8}{3}$ $\frac{18}{6}$

11 $3\frac{5}{6}$ $3\frac{2}{3}$

Identify Points

12 Write the fraction or mixed number for each lettered point above. Describe any patterns you see with the class.

a. _____

b. _____

c. _____

d. _____

e. _____

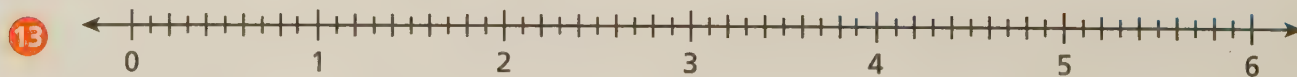
f. _____

g. _____

h. _____

i. _____

Mark and label the letter of each fraction or mixed number on the number line.



13 a. $\frac{1}{5}$

b. $\frac{7}{10}$

c. $1\frac{2}{5}$

d. $2\frac{1}{2}$

e. $3\frac{3}{10}$

f. $4\frac{2}{5}$

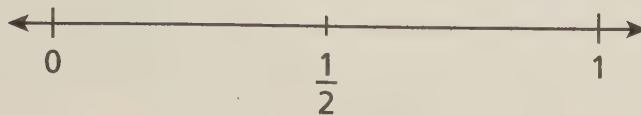
g. $4\frac{9}{10}$

h. $5\frac{1}{2}$

Fractions and Benchmarks

Decide if each fraction is closer to 0 or closer to 1.

Write *closer to 0* or *closer to 1*.



14 $\frac{1}{4}$ _____

15 $\frac{3}{4}$ _____

16 $\frac{7}{8}$ _____

Write $>$ or $<$ to make each statement true.

17 $\frac{5}{8}$ $\bigcirc$ $\frac{11}{12}$

18 $\frac{7}{12}$ $\bigcirc$ $\frac{1}{8}$

19 $\frac{3}{8}$ $\bigcirc$ $\frac{1}{6}$

Write the fractions in order from least to greatest.

20 $\frac{5}{12}, \frac{1}{8}, \frac{4}{6}$ _____

21 $\frac{3}{6}, \frac{3}{4}, \frac{2}{9}$ _____

What's the Error?

Dear Math Students,

I am baking cookies. My recipe calls for $\frac{5}{8}$ pound of walnuts. Walnuts come in $\frac{1}{2}$ -pound bags and 1-pound bags. My friend says that $\frac{5}{8}$ is closer to $\frac{1}{2}$ than it is to 1, so I should buy a $\frac{1}{2}$ -pound bag. I think my friend is wrong.

Do you agree with me or with my friend?

Can you help me decide what size bag of walnuts I should buy?

Your friend,

Puzzled Penguin



22 Write a response to Puzzled Penguin.

Use Benchmarks

The list below shows a variety of cooking ingredients and amounts.

Ingredients and Amounts (c = cup)	
wheat flour $1\frac{5}{8}$ c	white flour $\frac{4}{6}$ c
sugar $1\frac{1}{8}$ c	cornstarch $\frac{3}{8}$ c
oat bran $1\frac{4}{5}$ c	water $\frac{5}{6}$ c

Decide if each amount is closer to $\frac{1}{2}$ cup, $1\frac{1}{2}$ cups, or 2 cups.
Write *closer to $\frac{1}{2}$ c*, *closer to $1\frac{1}{2}$ c*, or *closer to 2 c*.

- 23 wheat flour _____ 24 white flour _____
 25 sugar _____ 26 cornstarch _____
 27 oat bran _____ 28 water _____

Decide which ingredient represents a greater amount.

- 29 sugar or wheat flour _____
 30 wheat flour or white flour _____
 31 sugar or oat bran _____
 32 oat bran or white flour _____
 33 List all the ingredients in the table in order from the greatest to the least amount. _____



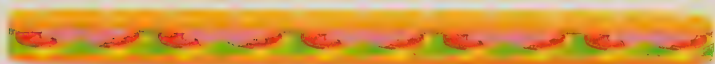
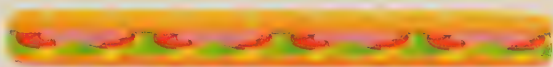
Check Understanding

Which is greater, $\frac{3}{8}$ or $\frac{5}{4}$? Draw a number line to show your solution.



Compare Fractions of Different-Size Wholes

Jon and his five friends want sandwiches. They make two sandwiches: one on a short loaf of bread and one on a longer loaf. Jon cuts each sandwich into 6 equal pieces. His friends think the pieces are not the same size.



1 Are Jon's friends correct? Explain.

2 What can Jon do to make sure everyone gets the same amount of food?

Hattie's dad orders one small, one medium, and one large pizza. He divides each pizza into 8 equal pieces. Hattie takes $\frac{1}{8}$ of the small pizza and her friend takes $\frac{1}{8}$ of the large pizza.



3 Hattie says she has less pizza than her friend. Is she correct? Explain.

4 What do these problems tell us about fractions?

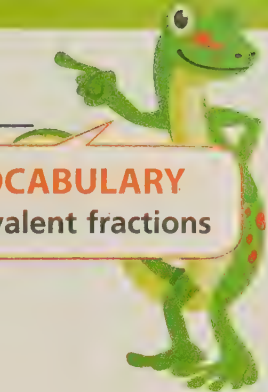
Fraction Word Problems

Show your work.

- 5 A shelter had 4 spaniel puppies and 6 beagle puppies. Jack adopted $\frac{1}{2}$ of the spaniel puppies, and Carmen adopted $\frac{1}{2}$ of the beagle puppies. Who adopted more puppies? How do you know?
-
-
- 6 Julio planted 16 daisies and 10 lilies. His goat ate 5 daisies and 5 lilies. Did the goat eat a greater fractional part of the daisies or the lilies? Explain.
-
-
- 7 A fruit market sells two different packages of oranges. Bags contain 12 oranges, and boxes contain 15 oranges. Both packages cost \$5.00. Which package is a better buy? Why?
-
-
- 8 The fourth grade has three running teams. Each team has 12 runners. In a race, $\frac{1}{4}$ of Team A, $\frac{1}{3}$ of Team B, and $\frac{1}{6}$ of Team C passed the first water stop at the same time. Which team had the most runners at the first water stop at that time? Explain.
-
-

Check Understanding

Circle the word to complete the sentence. When the wholes are different and the fractions are the same, the fractional part of the *smaller/larger* whole is greater.



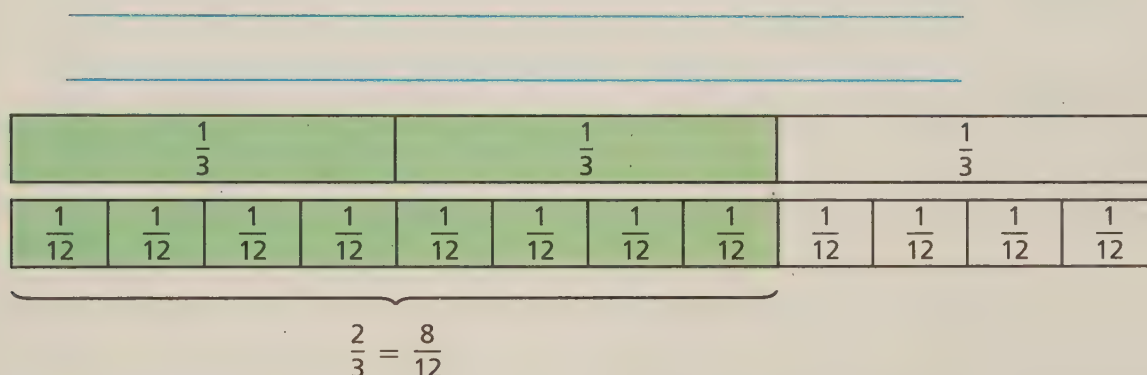
VOCABULARY
equivalent fractions

Equivalent Fractions

Read and discuss the problem situation.

Lewis works summers at Maria's Fruit Farm. One day, Maria agreed to give Lewis extra pay if he could sell $\frac{2}{3}$ of her supply of peaches. They started with 12 bags of peaches, and Lewis sold 8 of them.

- ① Lewis said to Maria, "Eight bags is $\frac{8}{12}$ of the 12 bags you wanted to sell. I think $\frac{2}{3}$ is the same as $\frac{8}{12}$. I can show you why." Lewis made this drawing. Did Lewis earn his pay? Explain your answer.



Two fractions that represent the same part of a whole are **equivalent fractions**. The fractions $\frac{2}{3}$ and $\frac{8}{12}$ are equivalent.

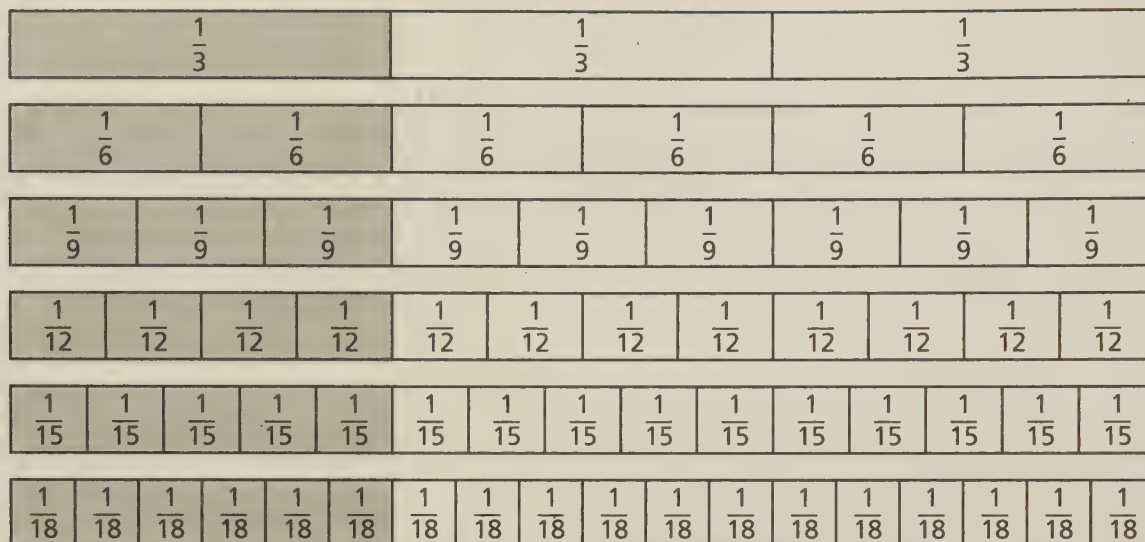
- ② Maria said, "You are just fracturing each third into 4 twelfths. You can show what you did using numbers." Here's what Maria wrote:

$$\frac{2}{3} = \frac{2 \times 4}{3 \times 4} = \frac{8}{12}$$

Discuss what Maria did. How does multiplying the numerator and denominator by 4 affect the fraction?

Use Fraction Bars to Find Equivalent Fractions

- 3 How do these fraction bars show equivalent fractions for $\frac{1}{3}$?



- 4 You can show how to find fractions equivalent to $\frac{1}{3}$ numerically. Fill in the blanks and finish the equations. Then explain how these fraction equations show equivalent fractions.

2 equal parts	3 equal parts	4 equal parts	— equal parts	— equal parts
$\times 2$	$\times 3$	$\times \underline{\quad}$	$\times \underline{\quad}$	$\times \underline{\quad}$
$\frac{1 \times 2}{3 \times 2} = \frac{2}{6}$	$\frac{1 \times \quad}{3 \times \quad} = \frac{\quad}{9}$	$\frac{1 \times \quad}{3 \times \quad} = \frac{\quad}{12}$	$\frac{1 \times \quad}{3 \times \quad} = \frac{\quad}{15}$	$\frac{1 \times \quad}{3 \times \quad} = \frac{\quad}{18}$

- 5 Tell whether the fractions are equivalent.

a. $\frac{1}{6}$ and $\frac{2}{12}$ _____

b. $\frac{3}{6}$ and $\frac{5}{9}$ _____

c. $\frac{6}{12}$ and $\frac{8}{15}$ _____

Use a Multiplication Table to Find Equivalent Fractions

The table on the right shows part of the multiplication table at the left. You can find fractions equivalent to $\frac{1}{3}$ by using the products in the rows for the factors 1 and 3.

	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100

	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
3	3	6	9	12	15	18	21	24	27	30

$$\frac{1 \times 6}{3 \times 6} = \frac{6}{18}$$

$$\frac{6 \div 6}{18 \div 6} = \frac{1}{3}$$

$\frac{1}{3}$	$\frac{1}{3}$	$\frac{1}{3}$
---------------	---------------	---------------

$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$	$\frac{1}{18}$
----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------	----------------

Complete each fraction equation. Look in the top row of the table above to find the multiplier.

6 $\frac{1 \times}{3 \times} = \frac{4}{12}$

7 $\frac{1 \times}{3 \times} = \frac{9}{27}$

8 $\frac{1 \times}{3 \times} = \frac{2}{6}$

9 $\frac{1 \times}{4 \times} = \frac{3}{12}$

10 $\frac{3 \times}{10 \times} = \frac{30}{100}$

11 $\frac{5 \times}{8 \times} = \frac{30}{48}$

12 Tell whether the fractions are equivalent.

a. $\frac{3}{4}$ and $\frac{12}{16}$ _____

b. $\frac{1}{2}$ and $\frac{5}{12}$ _____

c. $\frac{9}{10}$ and $\frac{90}{100}$ _____

What's the Error?

Dear Students,

I tried to find a fraction equivalent to $\frac{2}{3}$. Here's what I wrote.

$$\frac{2}{3} = \frac{5}{6}$$

Is my answer correct? If not, please help me understand why it is wrong.

Thank you.

Puzzled Penguin



- 13** Write a response to Puzzled Penguin.

Practice

Find a fraction equivalent to the given fraction.

14 $\frac{1}{4} \quad \frac{1 \times 2}{4 \times 2} = \frac{2}{\boxed{}}$

15 $\frac{3}{8} \quad \frac{3 \times 3}{8 \times 3} = \frac{9}{\boxed{}}$

16 $\frac{3}{10}$ _____

17 $\frac{3}{4}$ _____

18 $\frac{4}{5}$ _____

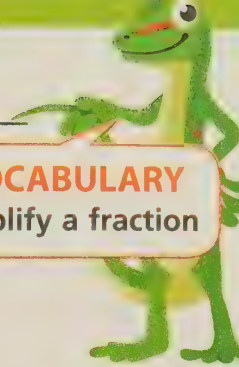
19 $\frac{7}{12}$ _____

20 $\frac{5}{6}$ _____

21 $\frac{7}{8}$ _____

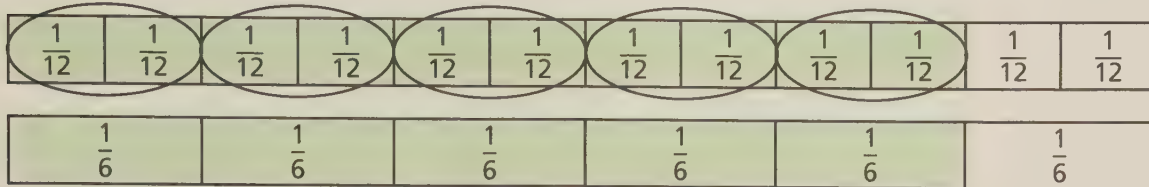
✓ Check Understanding

Write two fractions with the denominator 20:
one equivalent to $\frac{1}{4}$ and one equivalent to $\frac{7}{10}$.


VOCABULARY
simplify a fraction

Simplify Fractions

Maria had 12 boxes of apricots. She sold 10 of the boxes. Then Maria said that she sold $\frac{5}{6}$ of the boxes. She made this drawing to show that $\frac{10}{12}$ and $\frac{5}{6}$ are equivalent fractions.



- 1 Do you agree that $\frac{10}{12}$ and $\frac{5}{6}$ are equivalent? Why?

- 2 Maria formed groups of twelfths to get a greater unit fraction. What is that unit fraction?

- 3 How many twelfths did she put in each group? In other words, what was the group size? _____
- 4 Show how you can find the equivalent fraction by dividing the numerator and denominator by the group size.

$$\frac{10}{12} = \frac{10 \div \boxed{}}{12 \div \boxed{}} = \frac{\boxed{}}{\boxed{}}$$

To **simplify a fraction**, divide the numerator and denominator of a fraction by the same number to make an equivalent fraction made from fewer but larger unit fractions.

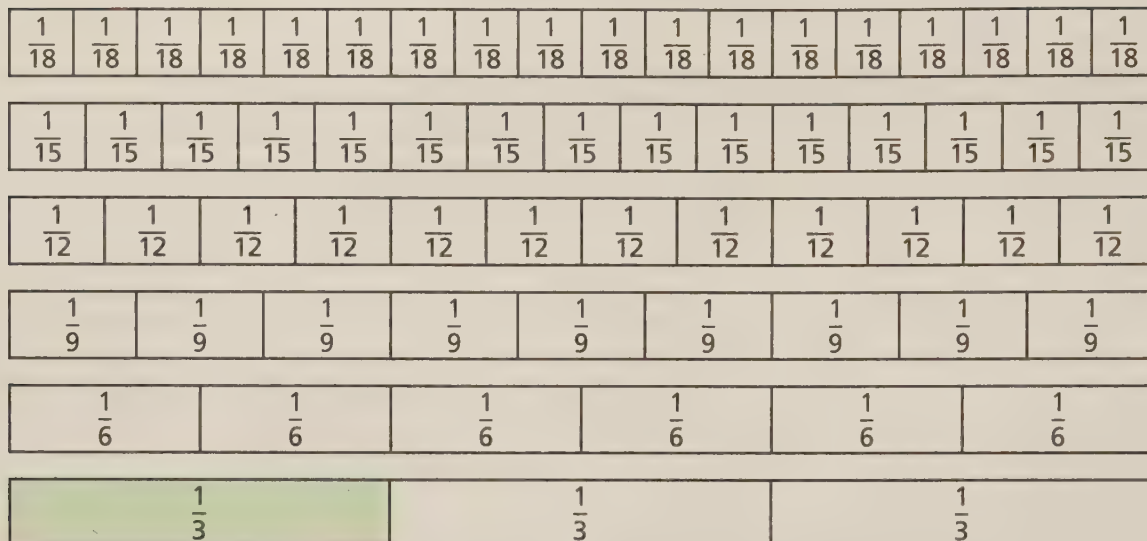
Use what you know to simplify each fraction to make an equivalent fraction with a unit fraction of $\frac{1}{6}$.

$$5 \quad \frac{8}{12} = \frac{8 \div \boxed{}}{12 \div \boxed{}} = \frac{\boxed{}}{6}$$

$$6 \quad \frac{14}{12} = \frac{14 \div \boxed{}}{12 \div \boxed{}} = \frac{\boxed{}}{6} = \boxed{} \frac{\boxed{}}{6}$$

Divide to Find Equivalent Fractions

- 7 Look at the thirds bar. Circle enough unit fractions on each of the other bars to equal $\frac{1}{3}$.



- 8 Discuss how the parts of the fraction bars you circled show this chain of equivalent fractions. Explain how each different group of unit fractions is equal to $\frac{1}{3}$.

$$\frac{6}{18} = \frac{5}{15} = \frac{4}{12} = \frac{3}{9} = \frac{2}{6} = \frac{1}{3}$$

- 9 Write the group size for each fraction in the chain of equivalent fractions. The first one is done for you.

6

- 10 Complete each equation by showing how you use group size to simplify. The first one is done for you.

$$\frac{6 \div 6}{18 \div 6} = \frac{1}{3}$$

$$\frac{5 \div \boxed{}}{15 \div \boxed{}} = \frac{1}{3}$$

$$\frac{4 \div \boxed{}}{12 \div \boxed{}} = \frac{1}{3}$$

$$\frac{3 \div \boxed{}}{9 \div \boxed{}} = \frac{1}{3}$$

$$\frac{2 \div \boxed{}}{6 \div \boxed{}} = \frac{1}{3}$$

Use a Multiplication Table to Find Equivalent Fractions

Multiplication table rows show relationships among equivalent fractions.

- 11** In Lesson 4, you used multiplication to find equivalent fractions by moving from left to right on the multiplication table. What happens to the fractions as you move from left to right? How does the size of the unit fraction change? How does the number of unit fractions change?

	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
3	3	6	9	12	15	18	21	24	27	30

Unsimplify a fraction.

$$\frac{1}{3} = \frac{1 \times 5}{3 \times 5} = \frac{5}{15}$$

- 12** You can also make equivalent fractions using division by simplifying when you move from right to left on the multiplication table. What happens to the fractions as you move from right to left? How does the size of the unit fraction change? How does the number of unit fractions change?

	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
3	3	6	9	12	15	18	21	24	27	30

Simplify a fraction.

$$\frac{5}{15} = \frac{5 \div 5}{15 \div 5} = \frac{1}{3}$$

Use a Multiplication Table to Find Equivalent Fractions (continued)

Here are two more rows from the multiplication table moved together. These rows can be used to generate a chain of fractions equivalent to $\frac{4}{8}$.

	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80

Complete each equation.

13 $\frac{4 \times}{8 \times} =$

14 $\frac{4 \times}{8 \times} =$

15 $\frac{20 \div}{40 \div} = \frac{4}{8}$

16 $\frac{36 \div}{72 \div} = \frac{4}{8}$

17 $\frac{12 \div}{24 \div} = \frac{4}{8}$

18 $\frac{24 \div}{48 \div} = \frac{4}{8}$

Complete each chain of equivalent fractions.

19 $\frac{1}{2} = \frac{\quad}{4} = \frac{\quad}{8}$

20 $\frac{\quad}{5} = \frac{\quad}{10} = \frac{\quad}{20}$

21 $\frac{\quad}{3} = \frac{\quad}{6} = \frac{\quad}{12}$

22 $\frac{\quad}{2} = \frac{\quad}{4} = \frac{\quad}{8}$

Practice Simplifying Fractions

Simplify each fraction.

23 $\frac{8 \div}{10 \div} =$

24 $\frac{6 \div}{8 \div} =$

25 $\frac{15 \div}{40 \div} =$

26 $\frac{10 \div}{12 \div} =$

27 $\frac{8 \div}{12 \div} =$

28 $\frac{20 \div}{30 \div} =$

29 $\frac{40 \div}{100 \div} =$

30 $\frac{75 \div}{100 \div} =$

Complete each chain of equivalent fractions.

31 $\frac{16}{8} = \frac{\quad}{4} = \frac{\quad}{2}$

32 $\frac{\quad}{20} = \frac{\quad}{10} = \frac{\quad}{5}$

33 $\frac{\quad}{12} = \frac{\quad}{6} = \frac{\quad}{3}$

34 $\frac{\quad}{8} = \frac{\quad}{4} = \frac{\quad}{2}$

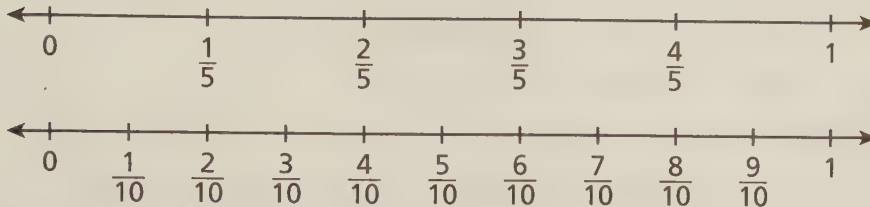
✓ Check Understanding

Explain why equivalent fractions are the same size even though the number and size of the parts differ.

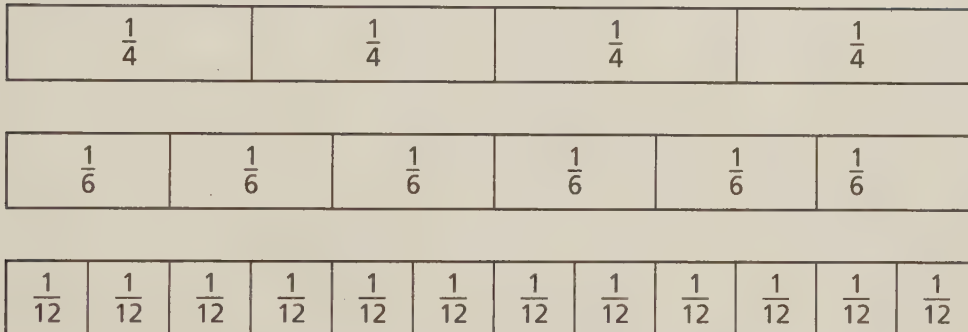


Compare Fractions Using Fraction Strips and Number Lines

- 1 Use the number lines to compare the fractions $\frac{4}{5}$ and $\frac{7}{10}$.



- 2 Use the fraction strips to compare the fractions $\frac{3}{4}$ and $\frac{4}{6}$.



Compare. Write $>$, $<$, or $=$.

3 $\frac{3}{4} \bigcirc \frac{7}{12}$

4 $\frac{3}{5} \bigcirc \frac{7}{12}$

5 $\frac{3}{5} \bigcirc \frac{6}{10}$

6 $\frac{2}{5} \bigcirc \frac{3}{6}$

7 $\frac{4}{10} \bigcirc \frac{1}{5}$

8 $\frac{2}{10} \bigcirc \frac{3}{8}$

Compare Fractions Using Common Denominators

VOCABULARY
common denominator

You can compare two fractions with different denominators by writing equivalent fractions that use the same unit fraction. The fractions will have a **common denominator**. You can use different strategies to do this. The ones shown below depend on how the denominators of the two fractions are related.

Case 1: One denominator is a factor of the other. Possible Strategy: Use the greater denominator as the common denominator.	Example Compare $\frac{3}{5}$ and $\frac{5}{10}$. Use 10 as the common denominator. $\frac{3 \times 2}{5 \times 2} = \frac{6}{10}$ $\frac{6}{10} > \frac{5}{10}, \text{ so } \frac{3}{5} > \frac{5}{10}.$
Case 2: The only number that is a factor of both denominators is 1. Possible Strategy: Use the product of the denominators as the common denominator.	Example Compare $\frac{5}{8}$ and $\frac{4}{5}$. Use 5×8, or 40, as the common denominator. $\frac{5 \times 5}{8 \times 5} = \frac{25}{40} \quad \frac{4 \times 8}{5 \times 8} = \frac{32}{40}$ $\frac{25}{40} < \frac{32}{40}, \text{ so } \frac{5}{8} < \frac{4}{5}.$
Case 3: There is a factor of both denominators that is not 1 and is not one of the denominators. Possible Strategy: Use a common denominator that is less than the product of the denominators.	Example Compare $\frac{5}{8}$ and $\frac{7}{12}$. 24 is a common multiple of 8 and 12. Use 24 as the common denominator. $\frac{5 \times 3}{8 \times 3} = \frac{15}{24} \quad \frac{7 \times 2}{12 \times 2} = \frac{14}{24}$ $\frac{15}{24} > \frac{14}{24}, \text{ so } \frac{5}{8} > \frac{7}{12}.$

Compare. Write $>$, $<$, or $=$.

9 $\frac{3}{5} \bigcirc \frac{2}{3}$

10 $\frac{10}{12} \bigcirc \frac{5}{6}$

11 $\frac{3}{4} \bigcirc \frac{8}{10}$

12 $\frac{4}{5} \bigcirc \frac{75}{100}$

13 $\frac{5}{8} \bigcirc \frac{3}{5}$

14 $\frac{2}{3} \bigcirc \frac{7}{10}$

What's the Error?

Dear Math Students,

My brother had a bowl of cherries to share.

My brother ate $\frac{3}{8}$ of the cherries. I ate $\frac{2}{5}$ of the cherries. I wrote two fractions with a common denominator and compared them.

$$\frac{3}{8 \times 5} = \frac{3}{40} \text{ and } \frac{2}{5 \times 8} = \frac{2}{40}$$

$$\frac{3}{40} > \frac{2}{40}, \text{ so } \frac{3}{8} > \frac{2}{5}.$$

I don't think my brother was fair. He had more than

I did! Do you agree?

Your friend,

Puzzled Penguin



15 Write a response to Puzzled Penguin.

Practice

Compare.

16 $\frac{3}{6} \bigcirc \frac{5}{10}$

17 $\frac{10}{12} \bigcirc \frac{7}{8}$

18 $\frac{2}{6} \bigcirc \frac{1}{5}$

19 $\frac{3}{8} \bigcirc \frac{1}{4}$

20 $\frac{3}{10} \bigcirc \frac{25}{100}$

21 $\frac{6}{12} \bigcirc \frac{2}{3}$

22 $\frac{2}{5} \bigcirc \frac{35}{100}$

23 $\frac{5}{12} \bigcirc \frac{9}{10}$

24 $\frac{45}{100} \bigcirc \frac{5}{10}$

25 $\frac{4}{5} \bigcirc \frac{11}{12}$

26 $\frac{3}{12} \bigcirc \frac{6}{8}$

27 $\frac{11}{12} \bigcirc \frac{9}{10}$

Practice (continued)

Solve.

Show your work.

- 28 Alexi and Kirsti are painting a fence around their garden. Alexi has painted $\frac{3}{8}$ of the fence. Kirsti has painted $\frac{5}{12}$ of the fence. Who has painted more of the fence?
-

- 29 Esther and Lavinia have the same math homework. Esther has finished $\frac{7}{8}$ of the homework. Lavinia has finished $\frac{3}{5}$ of the homework. Who has finished more of the homework?
-

- 30 Avram and Anton live on the same street. Avram's house is $\frac{3}{4}$ mile from the school. Anton's house is $\frac{7}{10}$ mile from the school. Which boy's house is a greater distance from the school?
-

- 31 Leola is reading a book. On Friday, she read $\frac{25}{100}$ of the book. On Saturday, she read $\frac{3}{8}$ of the book. On which day did she read more of the book?
-

Adding Fractions

Add.

32 $\frac{2}{10} + \frac{3}{100} =$ _____

33 $\frac{17}{100} + \frac{7}{10} =$ _____

34 $\frac{9}{10} + \frac{33}{100} =$ _____

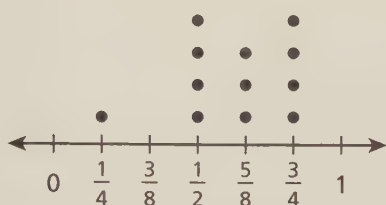
 Check Understanding

Explain how to compare the fractions $\frac{7}{12}$ and $\frac{3}{8}$.



Use Line Plots to Solve Problems

A line plot is a graph that shows data using a number line. Mateo wants to bake raisin bread. He has several recipes that each make one loaf of bread. The line plot shows the numbers of cups of sugar in the recipes.



Cups of Sugar

- 1 How many recipes for raisin bread does Mateo have?

- 2 How many of the recipes have more than $\frac{1}{2}$ cup of sugar?

- 3 What is the least amount of sugar in any recipe?

- 4 How much less sugar is in a recipe with the least sugar than in a recipe with the most sugar?

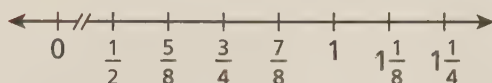
- 5 Mateo wants to try all the recipes with exactly $\frac{5}{8}$ cup of sugar. How much sugar does he need?

- 6 How much sugar would you expect a recipe for raisin bread to need? Explain your thinking.

Make a Line Plot

Mai cut up strips of color paper to make a collage. The lengths of the unused pieces are shown in the table.

- 7 Make a line plot to display the data.



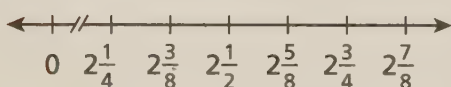
Paper Lengths (in inches)

Length (in inches)	Number of Pieces
$\frac{1}{2}$	4
$\frac{5}{8}$	2
$\frac{3}{4}$	2
$\frac{7}{8}$	3
$1\frac{1}{4}$	2

- 8 Mai placed the shortest pieces in a row end to end.
How long was the row? _____

A group of students measured the widths of their hands. The measurements are shown in the table.

- 9 Make a line plot to display the data.



Hand Width (in inches)

Width (in inches)	Number of Students
$2\frac{1}{4}$	1
$2\frac{3}{8}$	2
$2\frac{1}{2}$	2
$2\frac{5}{8}$	4
$2\frac{3}{4}$	2
$2\frac{7}{8}$	1

- 10 What is the difference between the width of the widest hand and the most common hand width? _____
- 11 Write a problem you could solve by using the line plot.
- _____
- _____



Check Understanding

Describe the parts of a line plot.

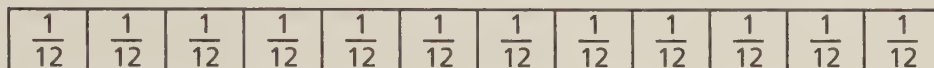
- 1 Write 5 fractions that are equivalent to $\frac{1}{4}$.

- 2 Simplify the fraction.

$$\frac{10}{25} = \underline{\hspace{2cm}}$$

- 3 Use the fraction strips to compare the fractions $\frac{5}{8}$ and $\frac{7}{12}$.

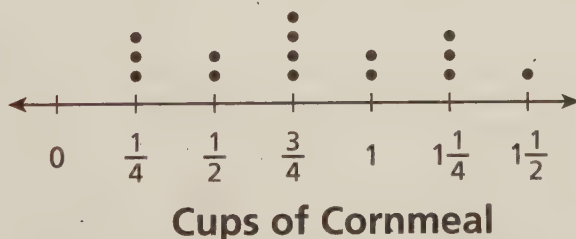
Write a true statement using one of the symbols $>$, $<$, or $=$.



Show your work.

- 4 Ethan plans for $\frac{3}{10}$ of the plants in his garden to be tomatoes. He wants $\frac{2}{5}$ of the plants to be peppers. Will Ethan plant more tomato plants or pepper plants?

- 5 The line plot shows the numbers of cups of cornmeal used in different cornbread recipes.



How much less cornmeal is in a recipe with the least cornmeal than in a recipe with the most cornmeal?

Add or subtract.

$$\begin{array}{r} 1 \quad 112 \\ + 465 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \quad 412 \\ - 381 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \quad 7,387 \\ + 372 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \quad 543,582 \\ - 451,866 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \quad 34,985 \\ + 9,077 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \quad 60,056 \\ - 34,163 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \quad 8,309 \\ + 6,582 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \quad 6,478 \\ - 5,116 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \quad 745 \\ + 619 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \quad 799 \\ - 476 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \quad 31,178 \\ - 8,636 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \quad 4,708 \\ - 3,647 \\ \hline \end{array}$$

$$\begin{array}{r} 13 \quad 55,268 \\ + 27,654 \\ \hline \end{array}$$

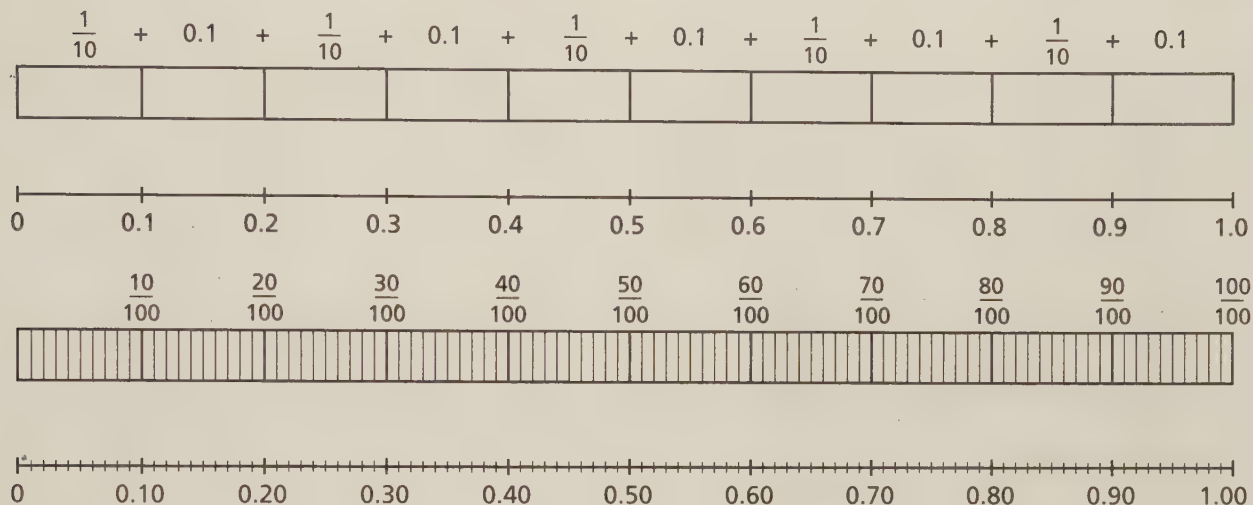
$$\begin{array}{r} 14 \quad 487,692 \\ + 369,045 \\ \hline \end{array}$$

$$\begin{array}{r} 15 \quad 805,245 \\ - 27,716 \\ \hline \end{array}$$

Dear Family:

In Lessons 8 through 16 of Unit 7 of *Math Expressions*, your child will be introduced to decimal numbers. Students will begin by using what they already know about pennies, dimes, and dollars to see connections between fractions and decimals.

Students will explore decimal numbers by using bars divided into tenths and hundredths. They will relate decimals to fractions, which are also used to represent parts of a whole.



Students will read, write, and model decimal numbers. They will learn to combine whole numbers with decimals. They will work with numbers such as 9.001, 1.72, and 12.9. Students will compare decimal numbers with other decimal numbers. They will also order decimals from least to greatest or greatest to least.

Students will apply their understanding of decimal concepts when they compare and order decimals.

Comparing Decimals

$$6.8 \bigcirc 3.42 \qquad 6.80 > 3.42$$

Adding a zero makes the numbers easier to compare.

Please contact me if you have any questions or comments.

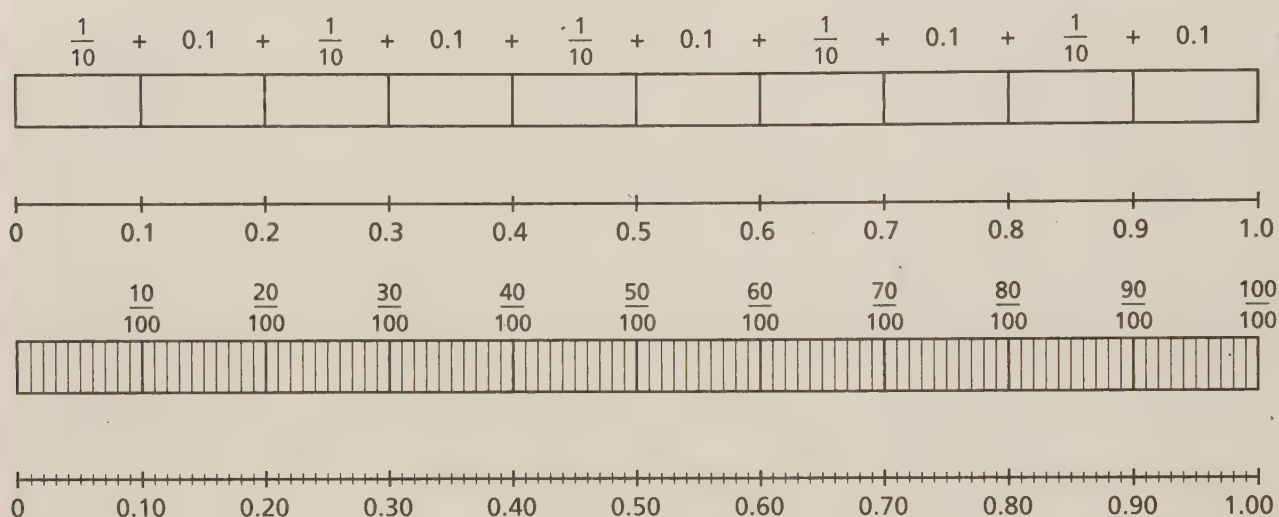
Thank you.

Sincerely,
Your child's teacher

Estimada familia:

En las Lecciones 8 a 16 de la Unidad 7 de Expresiones en matemáticas, se presentarán los números decimales. Para comenzar, los estudiantes usarán lo que ya saben acerca de las monedas de un centavo, de las monedas de diez y de los dólares, para ver cómo se relacionan las fracciones y los decimales.

Los estudiantes estudiarán los números decimales usando barras divididas en décimos y centésimos. Relacionarán los decimales con las fracciones que también se usan para representar partes del entero.



Los estudiantes leerán, escribirán y representarán números decimales.

Aprenderán a combinar números enteros con decimales. Trabajarán con números tales como 9.001, 1.72 y 12.9. Compararán números decimales con otros números decimales. También ordenarán decimales de menor a mayor o mayor a menor.

Al comparar y ordenar decimales, los estudiantes aplicarán los conceptos decimales que ya conozcan.

Comparar decimales

$$6.8 \bigcirc 3.42$$

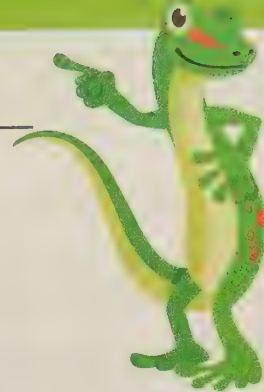
$$6.80 > 3.42$$

Añadir un cero
facilita la
comparación de
números.

Si tiene alguna duda o algún comentario, por favor comuníquese conmigo.

Gracias.

Atentamente,
El maestro de su niño



Tenths and Hundredths

Pennies and dimes can help you understand tenths and hundredths. Discuss what you see.



100 pennies = 10 dimes = 1 dollar

100 pennies = 1 dollar 10 dimes = 1 dollar

1 penny is $\frac{1}{100}$ of a dollar 1 dime is $\frac{1}{10}$ of a dollar

1 1 penny = $\frac{1}{100} = 0.01$

$\frac{10}{100}$ 10 of 100 equal parts

$\frac{1}{10}$ 1 of 10 equal parts



0.1

0.10

2 1 dime = $\frac{1}{10} = 0.1$

$$\frac{10}{100} + \frac{10}{100} = \frac{20}{100}$$

$$\frac{1}{10} + \frac{1}{10} = \frac{2}{10}$$



0.1 + 0.1 = 0.2

0.10 + 0.10 = 0.20

3 $\frac{10}{100} + \frac{10}{100} + \frac{5}{100} = \frac{25}{100}$

$$\frac{1}{10} + \frac{1}{10} + \frac{5}{100} = \frac{25}{100}$$



0.1 + 0.1 + 0.05 = 0.25

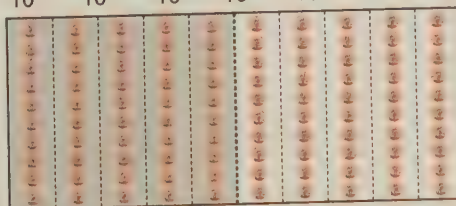
0.10 + 0.10 + 0.05 = 0.25

4 $\frac{25}{100} + \frac{25}{100} + \frac{25}{100} = \frac{75}{100}$



0.25 + 0.25 + 0.25 = 0.75

5 $\frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} + \frac{1}{10} = \frac{5}{10} = \frac{1}{2}$



0.1 + 0.1 + 0.1 + 0.1 + 0.1 = 0.5

0.10 + 0.10 + 0.10 + 0.10 + 0.10 = 0.50

Halves and Fourths

Equal shares of 1 whole can be written as a fraction or as a decimal. Each whole dollar below is equal to 100 pennies. Discuss the patterns you see.



6 1 of 2 equal parts

$$\frac{1}{2}$$



$$0.5 = \frac{5}{10}$$

$$0.50 = \frac{50}{100}$$

7 2 of 2 equal parts = 1 whole

$$\frac{1}{2} + \frac{1}{2} = \frac{2}{2}$$



$$0.5 + 0.5 = 1.00 = \frac{5}{10} + \frac{5}{10} = \frac{10}{10}$$

$$0.50 + 0.50 = 1.00 = \frac{50}{100} + \frac{50}{100} = \frac{100}{100}$$

8 1 of 4 equal parts

$$\frac{1}{4}$$



$$0.25$$

$$\frac{25}{100}$$

9 2 of 4 equal parts

$$\frac{1}{4} + \frac{1}{4} = \frac{2}{4}$$



$$0.25 + 0.25 = 0.50$$

$$\frac{25}{100} + \frac{25}{100} = \frac{50}{100}$$

10 3 of 4 equal parts

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{3}{4}$$



$$0.25 + 0.25 + 0.25 = 0.75$$

$$\frac{25}{100} + \frac{25}{100} + \frac{25}{100} = \frac{75}{100}$$

11 4 of 4 equal parts = 1 whole

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{4}{4}$$



$$0.25 + 0.25 + 0.25 + 0.25 = 1.00$$

$$\frac{25}{100} + \frac{25}{100} + \frac{25}{100} + \frac{25}{100} = \frac{100}{100}$$

Numbers Greater Than 1

Numbers greater than 1 can be written as fractions, decimals, or mixed numbers. A mixed number is a number that is represented by a whole number and a fraction.

Discuss the patterns you see in the equivalent fractions, decimals, and mixed numbers shown below.



12 5 of 4 equal parts = $1\frac{1}{4}$

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{5}{4}$$



$$\frac{4}{4} + \frac{1}{4}$$

$$0.25 + 0.25 + 0.25 + 0.25 + 0.25 = 1.25$$

$$\frac{25}{100} + \frac{25}{100} + \frac{25}{100} + \frac{25}{100} + \frac{25}{100} = \frac{125}{100} = 1\frac{25}{100}$$

13 6 of 4 equal parts = $1\frac{2}{4}$

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{6}{4}$$



$$\frac{4}{4} + \frac{2}{4}$$

$$0.25 + 0.25 + 0.25 + 0.25 + 0.25 + 0.25 = 1.50$$

$$\frac{25}{100} + \frac{25}{100} + \frac{25}{100} + \frac{25}{100} + \frac{25}{100} + \frac{25}{100} = \frac{150}{100} = \frac{100}{100} + \frac{50}{100} = 1 + \frac{50}{100} = 1\frac{50}{100}$$

14 7 of 4 equal parts = $1\frac{3}{4}$

$$\frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} = \frac{7}{4}$$



$$\frac{4}{4} + \frac{3}{4}$$

$$0.25 + 0.25 + 0.25 + 0.25 + 0.25 + 0.25 + 0.25 = 1.75$$

$$\frac{25}{100} + \frac{25}{100} + \frac{25}{100} + \frac{25}{100} + \frac{25}{100} + \frac{25}{100} + \frac{25}{100} = \frac{175}{100} = \frac{100}{100} + \frac{75}{100} = 1 + \frac{75}{100} = 1\frac{75}{100}$$

Model Equivalent Fractions and Decimals

Write a fraction and a decimal to represent the shaded part of each whole.

15



16



Divide each whole and use shading to show the given fraction or decimal.

17



0.75

18

 $\frac{9}{10}$

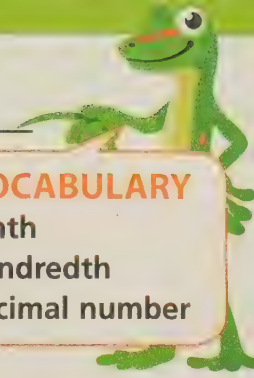
Shade these grids to show that $\frac{3}{2} = 1\frac{1}{2}$.

19



✓ Check Understanding

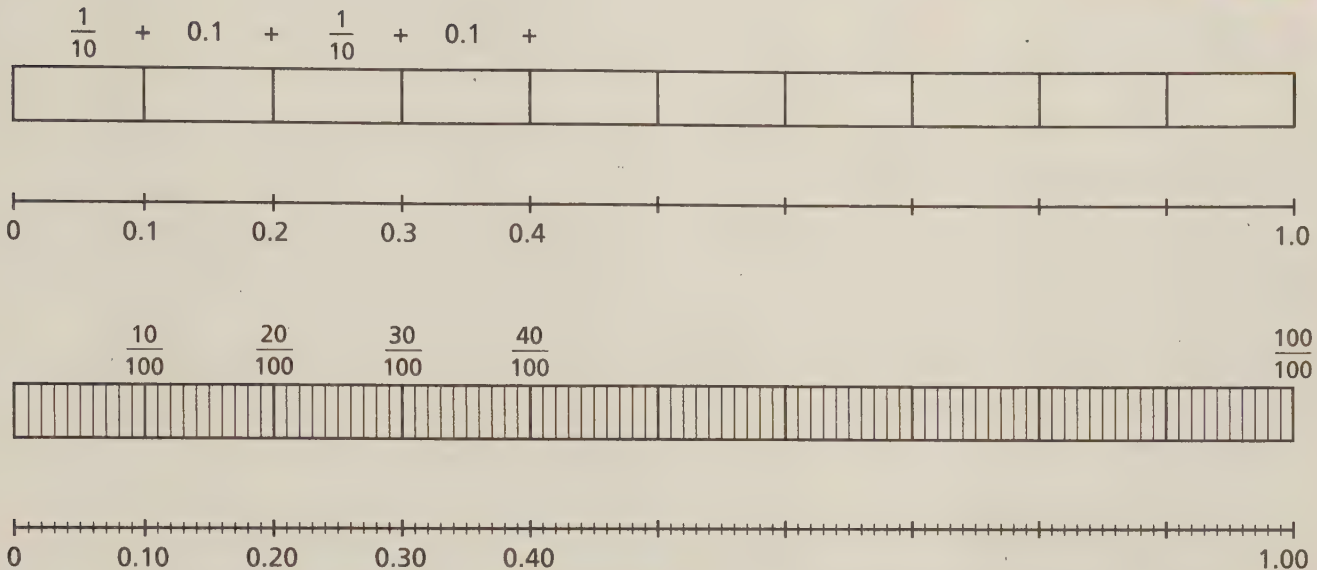
Name a fraction and a decimal that represents 60 cents as part of 1 dollar. Draw a diagram to support your answer.



VOCABULARY
tenth
hundredth
decimal number

Understand Tenths and Hundredths

Answer the questions about the bars and number lines below.



- The bars show **tenths** and **hundredths**. Finish labeling the bars and number lines using fractions and **decimal numbers**.
- Use what you know about fractions and about money (a dime = one tenth of a dollar and a penny = one hundredth of a dollar) to explain why 3 tenths is the same as 30 hundredths.

- One tenth is greater than one hundredth even though 10 is less than 100. Explain why this is true.

Practice Writing Decimal Numbers

Write these numbers in decimal form.

- 4 8 tenths _____ 5 6 hundredths _____ 6 35 hundredths _____
- 7 $\frac{92}{100}$ _____ 8 $\frac{2}{10}$ _____ 9 $\frac{9}{100}$ _____

Answer the questions below.

In the little town of Silver there are 100 people. Four are left-handed.

- 10 What decimal number shows the fraction of the people who are left-handed?
- _____

- 11 What decimal number shows the fraction of the people who are right-handed?
- _____

There are 10 children playing volleyball, and 6 of them are boys.

- 12 What decimal number shows the fraction of the players who are boys?
- _____

- 13 What decimal number shows the fraction of the players who are girls?
- _____

Complete the table.

	Name of Coin	Fraction of a Dollar	Decimal Part of a Dollar
14	Penny	$\frac{\quad}{100}$	
15	Nickel	$\frac{\quad}{100} =$	
16	Dime	$\frac{\quad}{100} =$	
17	Quarter	$\frac{\quad}{100} =$	

 **Check Understanding**

Explain why $0.7 = 0.70$.

^{0.1}
0.1 0.0 ^{0.01}1

^{0.2}
0.2 0.0 ^{0.02}2

^{0.3}
0.3 0.0 ^{0.03}3

^{0.4}
0.4 0.0 ^{0.04}4

^{0.5}
0.5 0.0 ^{0.05}5

^{0.6}
0.6 0.0 ^{0.06}6

^{0.7}
0.7 0.0 ^{0.07}7

^{0.8}
0.8 0.0 ^{0.08}8

^{0.9}
0.9 0.0 ^{0.09}9

.0 0

.0 0

.0 0

.0 0

> <





Write Decimal Numbers

Write a decimal number to represent the distance each person has traveled.

- 1 Aki has traveled 3 tenths of the distance, and Steven has traveled 5 tenths of the distance.

Aki _____ Steven _____

- 2 José has traveled 25 hundredths of the distance, and Lakisha has traveled 18 hundredths of the distance.

José _____ Lakisha _____

- 3 Yasir has traveled 7 tenths of the distance, and Danielle has traveled 59 hundredths of the distance.

Yasir _____ Danielle _____

- 4 Lea has traveled 8 hundredths of the distance, and Kwang-Sun has traveled 6 tenths of the distance.

Lea _____ Kwang-Sun _____

Practice Comparing

Write $>$, $<$, or $=$ to compare these numbers.

5 $0.4 \bigcirc 0.04$

6 $0.30 \bigcirc 0.3$

7 $0.7 \bigcirc 0.24$

8 $0.1 \bigcirc 0.8$

9 $0.61 \bigcirc 0.8$

10 $0.54 \bigcirc 0.2$

11 $0.11 \bigcirc 0.15$

12 $0.02 \bigcirc 0.2$

13 $0.5 \bigcirc 0.50$

14 $0.77 \bigcirc 0.3$

15 $0.06 \bigcirc 0.6$

16 $0.9 \bigcirc 0.35$

17 $0.4 \bigcirc 0.7$

18 $0.1 \bigcirc 0.10$

19 $0.5 \bigcirc 0.81$

20 $0.41 \bigcirc 0.39$

21 $0.9 \bigcirc 0.09$

22 $0.48 \bigcirc 0.6$

23 $0.53 \bigcirc 0.4$

24 $0.70 \bigcirc 0.7$

Word Problems With Decimal Numbers

Solve.

Carlos has been vacationing for one week of his 10-day vacation.

25 What decimal number represents the part of his vacation that is past? _____

26 What decimal number represents the part of his vacation that remains? _____

Jeremy spent 3 quarters and 1 nickel at the school bookstore.

27 What decimal part of a dollar did he spend? _____

28 What decimal part of a dollar did he not spend? _____

Dana is planning to run 1 tenth of a mile every day for 8 days.

29 What is the total distance she will run in 8 days? _____

30 If Dana runs 1 tenth of a mile each day for two more days, what will be the total distance she runs over the 10 days? _____

Practice Writing Decimal Numbers

Write the word name of each number.

31 0.1 _____

32 0.73 _____

33 0.09 _____

34 0.5 _____

Write a decimal number for each word name.

35 fourteen hundredths _____

36 two tenths _____

37 eight tenths _____

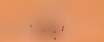
38 six hundredths _____

Check Understanding

Explain why $0.8 > 0.5$ using one or more of the methods taught in this lesson.



Discuss Symmetry Around the Ones

× 10 (Greater)			÷ 10 (Lesser)	
	1	10	1	10
	1	10	1	10
Hundreds	Tens	ONES	Tenths	Hundredths
100.	10.	1.	0.1	0.01
$\frac{100}{1}$	$\frac{10}{1}$	$\frac{1}{1}$	$\frac{1}{10}$	$\frac{1}{100}$
\$100.00 	\$10.00 	\$1.00 	\$0.10 	\$0.01 

- Discuss symmetries and relationships you see in the place value chart.
- Is it easier to see place value patterns in **a** or **b**? Discuss why.
 - 500 50 5 .5 .05
 - 500 50 5 0.5 0.05

Show and Read Decimal Numbers

Use your Decimal Secret Code Cards to make numbers on the frame.

	Hundreds	Tens	ONES	Tenths	Hundredths
Place value					
Make numbers					
Read numbers				and tenths	
				hundredths	

Write Numbers in Decimal Form

Read and write each mixed number as a decimal.

3 $3 \frac{1}{10}$ _____ 4 $5 \frac{7}{100}$ _____ 5 $2 \frac{46}{100}$ _____ 6 $28 \frac{9}{10}$ _____

Read and write each decimal as a mixed number.

7 12.8 _____ 8 3.05 _____ 9 4.85 _____ 10 49.7 _____

Read each word name. Then write a decimal for each word name.

11 sixty-one hundredths

12 six and fourteen hundredths

13 seventy and eight tenths

14 fifty-five and six hundredths

Expanded Form

Write each decimal in expanded form.

15 8.2 _____

16 17.45 _____

17 106.24 _____

18 50.77 _____

19 312.09 _____

20 693.24 _____

Solve.

21 There are 100 centimeters in 1 meter. A snake crawls 3 meters and 12 more centimeters. What decimal represents the number of meters the snake crawls?

22 There are 100 pennies in 1 dollar. A jar contains 20 dollars. You add 8 pennies to the jar. What decimal represents the number of dollars in the jar?

✓ Check Understanding

Describe how each place value in a decimal number is related to the place value to its left and to the place value to its right.

100	1	0	0	10	1	0	1
200	2	0	0	20	2	0	2
300	3	0	0	30	3	0	3
400	4	0	0	40	4	0	4
500	5	0	0	50	5	0	5
600	6	0	0	60	6	0	6
700	7	0	0	70	7	0	7
800	8	0	0	80	8	0	8
900	9	0	0	90	9	0	9

\$1	\$10	\$100
-----	------	-------

\$1	\$10	\$100
\$1	\$10	\$100

\$1	\$10	\$100
\$1	\$10	\$100
\$1	\$10	\$100

\$1	\$10	\$100
\$1	\$10	\$100
\$1	\$10	\$100
\$1	\$10	\$100

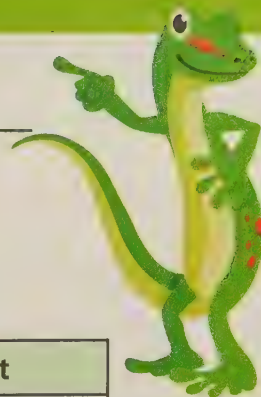
\$1	\$10	\$100
\$1	\$10	\$100
\$1	\$10	\$100
\$1	\$10	\$100
\$1	\$10	\$100

\$1	\$1	\$10	\$10	\$100	\$100
\$1		\$10		\$100	
\$1		\$10		\$100	
\$1		\$10		\$100	
\$1		\$10		\$100	

\$1	\$1	\$10	\$10	\$100	\$100
\$1	\$1	\$10	\$10	\$100	\$100
\$1		\$10		\$100	
\$1		\$10		\$100	
\$1		\$10		\$100	

\$1	\$1	\$10	\$10	\$100	\$100
\$1	\$1	\$10	\$10	\$100	\$100
\$1	\$1	\$10	\$10	\$100	\$100
\$1		\$10		\$100	
\$1		\$10		\$100	

\$1	\$1	\$10	\$10	\$100	\$100
\$1	\$1	\$10	\$10	\$100	\$100
\$1	\$1	\$10	\$10	\$100	\$100
\$1	\$1	\$10	\$10	\$100	\$100
\$1		\$10		\$100	



Zeros in Greater Decimal Numbers

Use the tables to answer Problems 1–4.

- 1 What happens if we insert a zero to the right of a whole number?

- 2 What happens if we insert a zero to the right of a decimal number?

- 3 What happens if we insert a zero to the left of a whole number?

- 4 What happens if we insert a zero to the left of a decimal number just after the decimal point?

- 5 Are whole numbers and decimal numbers alike or different when it comes to putting in extra zeros? Explain your answer.

- 6 Do the pairs of numbers below have the same value? Why or why not?

0.6 and .6 _____ .25 and 0.25 _____ 0.9 and 0.90 _____

Insert Zeros to the Right			
Whole Numbers		Decimal Numbers	
3	30	0.3	0.30
67	670	6.7	6.70

Insert Zeros to the Left			
Whole Numbers		Decimal Numbers	
3	03	0.3	0.03
67	067	6.7	6.07

Compare Decimals

You can use your understanding of place value and the placement of zeros in decimal numbers to compare decimal numbers.

Problem:

Which of these numbers is the greatest: 2.35, 2.3, or 2.4?

Solution:

2.35 2.30 With the places aligned and the extra zeros added, we can see which is greatest.
 2.40

Write $>$, $<$, or $=$ to compare these numbers.

- 7 27.5 8.37 8 6.04 5.98 9 7.36 7.38 10 36.9 37.8
 11 0.5 0.26 12 0.09 0.9 13 0.8 0.80 14 0.42 0.6

Use the table to answer Problems 15 and 16.

- 15 Francis measured some common insects. The table shows the lengths in centimeters. List the insects from longest to shortest.

Lengths of Insects	
Name	Length
Ladybug	0.64 cm
Moth	0.3 cm
Mosquito	0.32 cm
Cricket	1.8 cm
Bumblebee	2 cm

Longest

Shortest

- 16 Maya read about a stick insect that is 1.16 centimeters long. She compared the length with the lengths in the table. Maya says the mosquito is longer than the stick insect because $0.32 > 0.16$. Is Maya's reasoning correct? Explain.

✓ Check Understanding

Write $>$, $<$, or $=$ to compare these numbers.

20.7 20.07



Math and Autumn Leaves

The weather in different parts of the United States has a noticeable effect on plants and trees. In warm parts of the country, trees can keep their leaves all year long. In the northern states, fall weather causes leaves to change color. People from around the country plan trips to see and photograph the red, yellow, orange, and brown leaves. A fall leaf-viewing trip could involve driving through a national forest, biking along a rail trail, or hiking into the mountains.



Solve.

Show your work.

- 1** One popular park for photographing leaves in autumn is Macedonia Brook State Park in Kent, Connecticut. The Yellow Trail is the shortest hiking trail and is $\frac{51}{100}$ mile long. What is this fraction written as a decimal?
- _____

- 2** The Rogers family is visiting Massachusetts to see the leaves change color. The Old Eastern Marsh Trail is $1\frac{2}{5}$ miles long. The Bradford Rail Trail is $1\frac{3}{10}$ miles long. The Rogers family wants to take the longer trail. Which trail should they take?
- _____

Clarkston Park

Joshua and Lily are going north to participate in a walking tour in Clarkston Park to photograph the leaves. Here is the trail map of the different walking trails.



- 3 Write the length of the West Trail as a mixed number.

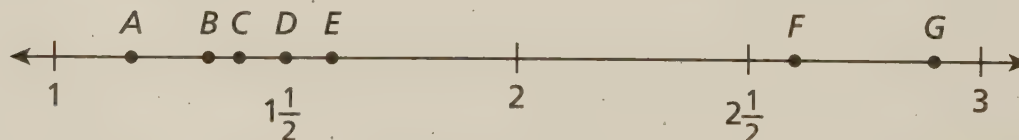
- 4 Which trail is shorter: the West Trail or the North Trail? Write the comparison using $>$, $<$, or $=$.

- 5 Write the length of the Lower Trail as a mixed number.

- 6 Which trail is longer: the Lower Trail or the South Trail? Write the comparison using $>$, $<$, or $=$.

- 7 Write a fraction that is equivalent to the length of the North Trail.

- 8 Use the number line below and the benchmark numbers to name the trail whose length in miles is represented by each point.



A: _____

E: _____

B: _____

F: _____

C: _____

G: _____

D: _____

VOCABULARY
 thousandth

Extend the Place Value Chart

× 10 (Greater)				÷ 10 (Lesser)		
Thousands	Hundreds	Tens	ONES	Tenths	Hundredths	Thousandths
1,000.	100.	10.	1.	0.1	0.01	0.001
$\frac{1,000}{1}$	$\frac{100}{1}$	$\frac{10}{1}$	$\frac{1}{1}$	$\frac{1}{10}$	$\frac{1}{100}$	$\frac{1}{1,000}$
\$1,000.00 	\$100.00 	\$10.00 	\$1.00 	\$0.10 	\$0.01 	\$0.001 

- 1 Are there symmetries around the ones place for the thousands and thousandths places? Discuss why or why not.

Write the equivalent number of hundredths and thousandths.

2 $0.2 = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$ 3 $0.9 = \underline{\hspace{2cm}} = \underline{\hspace{2cm}}$

Use your Decimal Secret Code Cards to make numbers on the frame.

Place value	Thousands	Hundreds	Tens	ONES	Tenths	Hundredths	Thousandths
Make numbers							
Read numbers					and tenths		
					hundredths		
					thousandths		

Write Numbers in Decimal Form

Read and write each mixed number as a decimal.

4 $6\frac{3}{100}$ _____ 5 $12\frac{705}{1,000}$ _____ 6 $41\frac{4}{1,000}$ _____ 7 $7\frac{9}{10}$ _____

Read and write each decimal as a mixed number.

8 26.312 _____ 9 2.1 _____ 10 3.88 _____ 11 8.450 _____

Read each word name. Then write a decimal for each word name.

12 five tenths

13 nine and one thousandth

14 ten and two hundredths

15 six hundred eight thousandths

Expanded Form

Write each decimal in expanded form.

Example: $2.936 (2 \times 1) + (9 \times 0.1) + (3 \times 0.01) + (6 \times 0.001)$

16 14.25 _____ 17 320.401 _____

18 6.008 _____ 19 1,086.9 _____

Solve.

20 A new container of hobby beads contains 1,000 beads. Sara has 1 new container, and 14 leftover beads. What decimal number represents the number of containers Sara has?

21 A new container of hobby beads contains 1,000 beads. Wia has $2\frac{1}{2}$ new containers. Write three different decimal numbers to represent the number of containers Wia has.



Check Understanding

Describe how the thousandths place is related to the hundredths place.

1,000	1,000	0.001	0
2,000	2,000	0.002	0
3,000	3,000	0.003	0
4,000	4,000	0.004	0
5,000	5,000	0.005	0
6,000	6,000	0.006	0
7,000	7,000	0.007	0
8,000	8,000	0.008	0
9,000	9,000	0.009	0

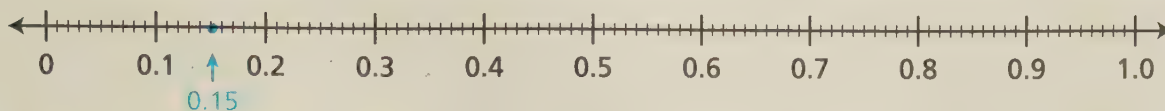


	\$1,000	
	\$1,000 \$1,000	
	\$1,000 \$1,000 \$1,000	
	\$1,000 \$1,000 \$1,000 \$1,000	
	\$1,000 \$1,000 \$1,000 \$1,000 \$1,000	
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	\$1,000 \$1,000 \$1,000 \$1,000 \$1,000	\$1,000
	\$1,000 \$1,000 \$1,000 \$1,000 \$1,000	\$1,000



Use a Number Line

You can use a number line to compare and order decimal numbers.



1 Label points on the number line above to show 0.09, 0.23, and 0.17.

2 Write the numbers in Exercise 1 in order from least to greatest.

3 How could you use the number line to compare 0.59 and 0.83?

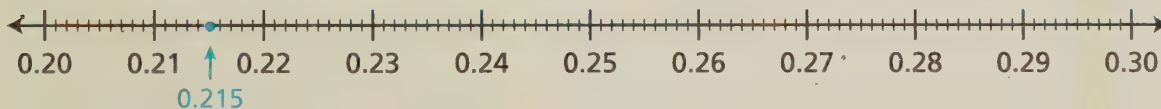
Order the decimals from least to greatest.

4 0.5, 0.2, 0.1 _____

5 0.13, 0.08, 0.2 _____

6 0.12, 0.3, 0.04 _____

7 1.0, 0.1, 0.11 _____

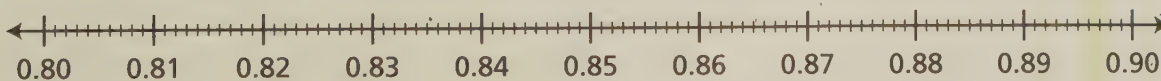


8 Label points on the number line above to show 0.250, 0.271, and 0.225.

9 Write the numbers in Exercise 8 in order from greatest to least.

10 Explain how you know 0.310 is greater than 0.269.

Use the number line to order the decimals from greatest to least.



11 0.815, 0.85, 0.891 _____

12 0.882, 0.808, 0.822 _____

Use Place Value

You can use your understanding of place value and the placement of zeros in decimal numbers to compare and order decimal numbers.

Problem:

Which of these numbers is the greatest: 0.35, 0.318, or 0.4?

Solution:

0.350

0.318

0.400

With the places aligned and the extra zeros added, we can see which is greatest.

Write $<$, $>$, or $=$ to compare the numbers.

13 $0.36 \bigcirc 0.82$

14 $0.405 \bigcirc 0.62$

15 $0.98 \bigcirc 0.7$

16 $2.3 \bigcirc 0.95$

17 $0.626 \bigcirc 0.65$

18 $0.850 \bigcirc 0.85$

19 $0.7 \bigcirc 0.07$

20 $0.54 \bigcirc 0.504$

- 21 A geologist measured the mass of some rock samples. The table shows the mass in kilograms. List the rocks from greatest mass to least mass.

Greatest _____

Least _____

Mass of Rocks	
Type	Mass
Quartz	0.25 kg
Sandstone	0.062 kg
Slate	0.125 kg
Marble	0.725 kg
Granite	0.8 kg

Circle the number in each group that does *not* have the same value as the others.

22 0.610 0.601 0.61 .61

23 4.8 4.80 4.08 4.800

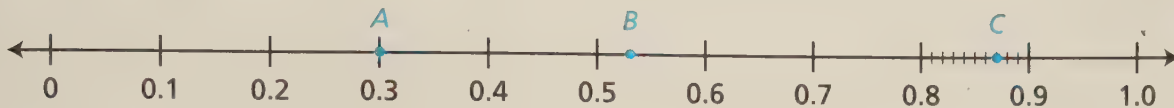
✓ Check Understanding

Explain how you can use a number line to order 0.73, 0.39, and 0.91 from least to greatest.



Round to the Nearest Tenth

The number line below shows one whole divided into tenths.



- 1 What decimal tenth is marked by point A? _____
- 2 Point B is between two decimal tenths. To which tenth is it nearer? _____
- 3 Point C is also between two decimal tenths. The space between these tenths has been divided into hundredths. What decimal hundredths are between 0.8 and 0.9?

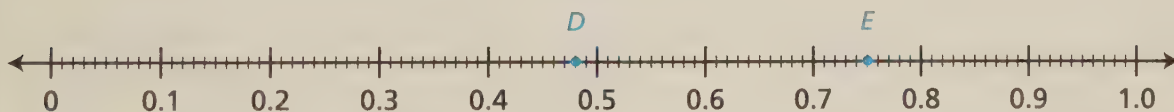
- 4 What decimal hundredth is marked by point C? _____
- 5 To which tenth is this hundredth nearer? (This is the way you round a hundredth to the nearest tenth.) _____

Rounding Frames

0.6
B
0.5

0.9
C
0.8

The number line below shows one whole divided into hundredths.



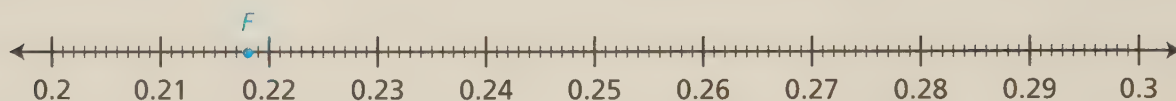
- 6 What hundredth is marked by point D? _____
Round this hundredth to the nearest tenth. _____
- 7 When you want to round a number that is exactly halfway between two rounding units, round up to the next greater number. What number is marked by point E? _____
Round this number to the nearest tenth. _____

0.5
D
0.4

0.8
E
0.7

Round with Thousandths

The number line below shows one tenth divided into ten hundredths.



Point F is between two decimal hundredths. The space between these hundredths has been divided into thousandths.

8 What decimal number is marked by point F ? _____

9 Which tenth is point F closer to, 0.2 or 0.3? _____

0.22

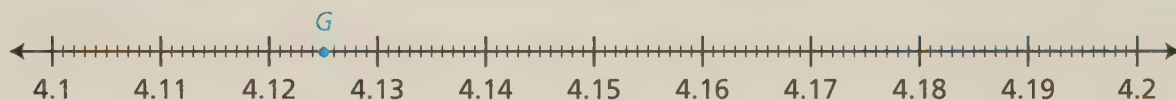
 F

0.21

0.3

 F

0.2



10 What two hundredths is point G between? _____

11 What decimal number is marked by point G ? _____

4.2

 G

4.1

What is this number rounded to the nearest tenth? _____

Practice Rounding

Round to the nearest tenth.

12 0.72 _____

13 0.35 _____

14 3.46 _____

15 0.238 _____

16 4.182 _____

17 5.225 _____

18 0.659 _____

19 0.198 _____

20 0.907 _____



Check Understanding

What is 9.573 rounded to the nearest tenth? _____

Write the correct answer.

- 1 Read and write the mixed number as a decimal.

$$21 \frac{206}{1,000}$$

- 2 Write the number in expanded form.

302.651

- 3 The table shows scores in a gymnastics competition. List the competitors in order from the highest score to the lowest score.

Competitor	Score
Rahul	8.950
Andrei	7.895
Saul	8.595
Alberto	8.095

- 4 Use the number line. What is 0.273 rounded to the nearest tenth?



- 5 There are 1,000 seats in a theater. 455 seats are in the lower level. What decimal number represents the number of seats in the lower level?
- _____

Multiply.

1 $1 \times 3 = \square$

2 $3 \times 2 = \square$

3 $4 \times 3 = \square$

4 $4 \times 1 = \square$

5 $2 \times 5 = \square$

6 $6 \times 1 = \square$

7 $6 \times 6 = \square$

8 $8 \times 4 = \square$

9 $5 \times 7 = \square$

10 $9 \times 3 = \square$

11 $8 \times 8 = \square$

12 $6 \times 9 = \square$

13 $7 \times 10 = \square$

14 $10 \times 10 = \square$

15 $8 \times 9 = \square$

- 1 For Exercises 1a–1d, write $>$ or $<$ to make the inequality true.

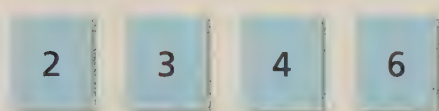
1a. $\frac{3}{5} \bigcirc \frac{1}{5}$

1c. $\frac{9}{10} \bigcirc \frac{9}{12}$

1b. $\frac{2}{8} \bigcirc \frac{2}{3}$

1d. $\frac{5}{8} \bigcirc \frac{7}{8}$

- 2 Choose numbers from the tiles to make an equivalent fraction with the least possible denominator.



$$\frac{8}{12} = \frac{\boxed{}}{\boxed{}}$$

- 3 Farid measures the masses of four books in kilograms. He records the data in the table. Which two books have the same mass?

Masses of Books				
Book	1	2	3	4
Mass (kg)	1.12	1.20	1.02	1.2

- (A) Books 1 and 3 (C) Books 3 and 4
(B) Books 2 and 3 (D) Books 2 and 4

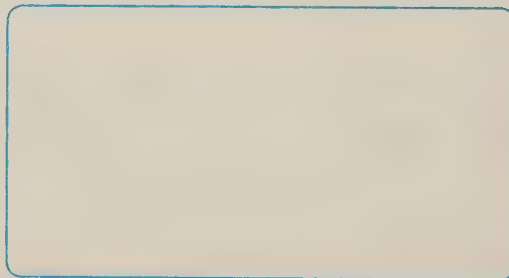
- 4 In a survey, $\frac{7}{10}$ of the students said they watched the news last week. Complete the fraction equation.

$$\frac{7}{10} = \frac{\boxed{}}{100}$$

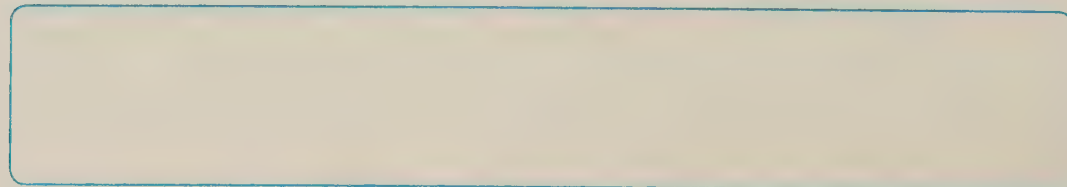
- 5 A trail is $\frac{7}{12}$ mile long. Select the trail length that is shorter than $\frac{7}{12}$ mile. Mark all that apply.
- (A) $\frac{3}{8}$ mile (B) $\frac{2}{3}$ mile (C) $\frac{3}{4}$ mile (D) $\frac{1}{2}$ mile
- 6 On average, a chimpanzee spends about $\frac{2}{5}$ of the day sleeping. A squirrel spends about $\frac{5}{8}$ of the day sleeping. A three-toed sloth spends about $\frac{5}{6}$ of the day sleeping. For Exercises 6a–6d, choose True or False to best describe the statement.
- 6a. A chimpanzee spends more of the day sleeping than a three-toed sloth. ☐ True ☐ False
- 6b. A squirrel spends more of the day sleeping than a chimpanzee. ☐ True ☐ False
- 6c. A three-toed sloth spends more of the day sleeping than a squirrel. ☐ True ☐ False
- 6d. A chimpanzee sleeps more than the other two types of animals. ☐ True ☐ False
- 7 Emily and Leah each brought a full water bottle to practice. Their bottles were the same shape, but Leah's bottle was taller than Emily's. Each girl drank $\frac{1}{2}$ of her water.

Part A

Draw a picture to show Emily and Leah's water bottles. Shade the bottles to show how much water each girl originally had. Then cross out the amount each girl drank.

**Part B**

Did each girl drink the same amount of water? Explain.



- 8 Locate and draw a point on the number line for the fraction or mixed number. Then label it with its corresponding letter.



- a. $4\frac{1}{2}$ b. $\frac{7}{8}$ c. $1\frac{3}{4}$ d. $3\frac{1}{4}$ e. $2\frac{3}{8}$

- 9 For Exercises 9a–9c, complete the chain of equivalent fractions.

9a. $\frac{2}{5} = \frac{\boxed{}}{10} = \frac{\boxed{}}{15} = \frac{\boxed{}}{20}$

9b. $\frac{6}{12} = \frac{\boxed{}}{6} = \frac{1}{\boxed{}}$

9c. $\frac{5}{8} = \frac{\boxed{}}{16} = \frac{\boxed{}}{24} = \frac{20}{\boxed{}}$

- 10 Write five fractions that are equivalent to $\frac{1}{6}$.

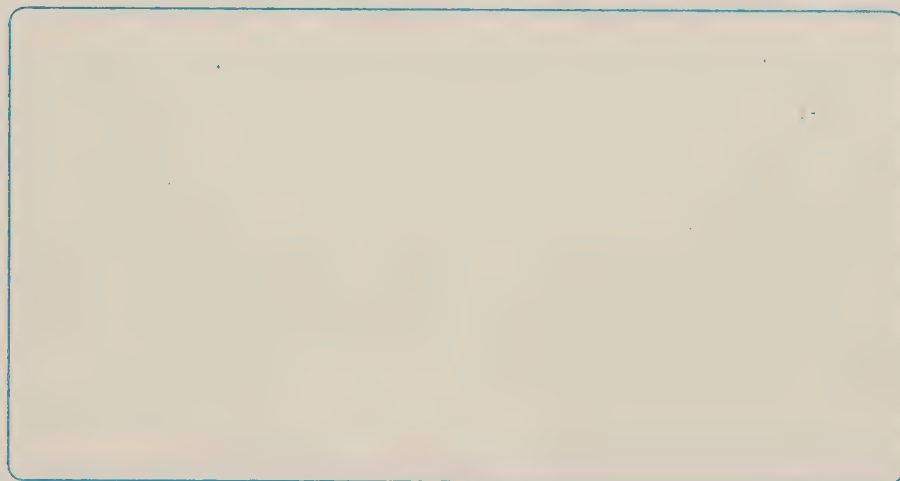
- 11 A lizard has a length of $\frac{43}{100}$ meter. Write $\frac{43}{100}$ in decimal form.

- 12 Tione is researching beetles. She records the lengths of some beetles in the table.

Length (in inches)	Number of Beetles
$\frac{1}{4}$	2
$\frac{1}{2}$	3
$\frac{3}{4}$	6
1	1
$1\frac{1}{4}$	4
$1\frac{1}{2}$	2

Part A

Make a line plot to display the data.

**Part B**

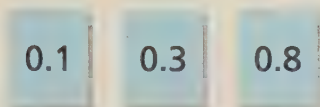
How many beetles are less than 1 inch long? _____ beetles

- 13 Use the number line. Round each number to the nearest tenth.



13a. 4.125 _____ 13b. 4.156 _____ 13c. 4.182 _____

- 14 Write a decimal to make the statement true.



$\boxed{} > 0.650$

$0.15 > \boxed{}$

$\boxed{} = 0.30$

- 15 A forest ranger saw 10 deer. There were 2 male and 8 female deer. What fraction or decimal number shows the part of the deer that were female? Mark all that apply.

(A) $\frac{2}{10}$

(C) 0.80

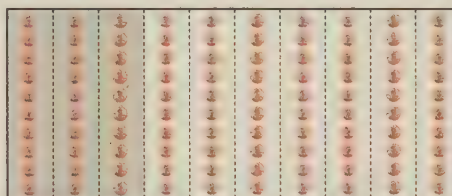
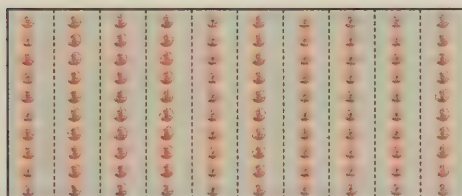
(E) $\frac{8}{10}$

(B) 0.2

(D) 0.08

(F) 0.8

- 16 Each model represents 1 whole dollar. The shaded part represents the part of a dollar Loren took to the bank.



Part A

Write a mixed number to represent the part of a dollar Loren took to the bank.

Part B

Loren says she can represent the part of a dollar she took to the bank as 1.3 but not as 1.30. Do you agree? Why or why not?

- 17 Beth wrote the number sixty-one and five hundred eight thousandths in decimal form.

What did Beth write?

- 18 Trading cards come in packs of 1,000. Becca has 3 full packs and 7 more cards. For Exercises 18a–18d, choose Yes or No to tell whether the number represents the number of packs Becca has.

- | | | |
|----------------------------|---------------------------|--------------------------|
| 18a. 3.007 | ☐ Yes | ☐ No |
| 18b. 3 and 7 thousandths | ☐ Yes | ☐ No |
| 18c. three and one seventh | ☐ Yes | ☐ No |
| 18d. 3.7 | ☐ Yes | ☐ No |

- 19 A vet measures the mass of three puppies. Suzy's mass is 3.3 kilograms. Buster's mass is 3.03 kilograms, and Charlie's mass is 3.30 kilograms.

Part A

Is Suzy's mass the same as Charlie's? Explain.

Part B

A fourth puppy, Pluto, has a mass of 3.33 kilograms. Which of the four puppies has the least mass? Explain how you found your answer.

Bicycle Parking Only

Jacob rides his bike to school and parks it in the bicycle rack near the front entrance. He counted the number of bicycles in the rack each school day for a week and recorded his count in this table.

Bicycles in the Front Entrance Rack					
Day	Monday	Tuesday	Wednesday	Thursday	Friday
Number of Bicycles	3	7	4	8	10

- 1 The rack can hold up to 10 bicycles. What fraction of the bicycle rack was used each day?

- 2 Jenny thinks that on Tuesday, about $\frac{1}{2}$ of the bicycle rack was used. Jacob thinks about $\frac{1}{2}$ of the rack was used on Wednesday. Who is correct? Use a diagram or number line to justify your answer.

- 3 What decimal number shows the part of the bicycle rack that was used each day?

- 4 Jacob thinks it is easier to write decimals than fractions to describe how much of the rack was used each day. Do you think he would feel the same if the rack had spaces for 12 bikes? Explain your reasoning.

Jacob counted the number of bicycles at the back entrance for the same week. The back entrance bicycle rack also holds 10 bicycles. His results are in the table below.

Bicycles in the Back Entrance Rack					
Day	Monday	Tuesday	Wednesday	Thursday	Friday
Number of Bicycles	7	4	8	7	2

- 5 What fraction of the spaces was used in the back entrance rack on Friday?

- 6 On which day of the week were $\frac{4}{5}$ of the spaces in the back entrance rack used? Explain how you solved the problem.

- 7 What decimal number shows the part of the back entrance rack that was not used each day?

- 8 On the following Monday, $\frac{3}{5}$ of the front entrance rack was used and 0.3 of the back entrance rack was used. Were there more bikes in the front rack or the back rack? Explain.

Dear Family:

In the first half of Unit 8, your child will be learning to recognize and describe geometric figures. One type of figure is an angle. Your child will use a protractor to find the measures of angles.



Other figures, such as triangles, may be named based on their angles and sides.



Right
triangle

One right
angle (90°)



Acute
triangle

All angles
less than 90°



Obtuse
triangle

One angle
greater than 90°



Equilateral
triangle

all three sides
of equal length



Isosceles
triangle

two sides
of equal length



Scalene
triangle

three sides of
different lengths

Be sure that your child continues to review and practice the basics of multiplication and division. A good understanding of the basics will be very important in later math courses when students learn more difficult concepts in multiplication and division.

If you have any questions or comments, please contact me.

Thank you.

Sincerely,
Your child's teacher

Estimada familia:

En la primera parte de la Unidad 8, su niño aprenderá a reconocer y a describir figuras geométricas. Un ángulo es un tipo de figura. Su niño usará un transportador para hallar las medidas de los ángulos.

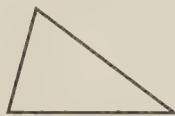


Otras figuras, tales como los triángulos, se nombran según sus ángulos y lados.



Triángulo
rectángulo

Tiene un ángulo
recto (90°)



Triángulo
acutángulo

Todos los ángulos
son menores que 90°



Triángulo
obtusángulo

Tiene un ángulo
mayor que 90°



Triángulo
equilátero

los tres lados
tienen la misma
longitud



Triángulo
isósceles

dos lados
tienen la misma
longitud



Triángulo
escaleno

los tres lados
tienen diferente
longitud

Asegúrese de que su niño siga repasando y practicando las multiplicaciones y divisiones básicas. Es importante que domine las operaciones básicas para que, en los cursos de matemáticas de más adelante, pueda aprender conceptos de multiplicación y división más difíciles.

Si tiene alguna pregunta o algún comentario, por favor comuníquese conmigo.

Gracias.

Atentamente,
El maestro de su niño

acute angle

angle

acute triangle

circle

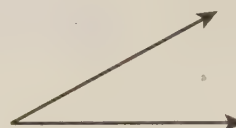
adjacent sides

congruent

A figure formed by two rays with the same endpoint.



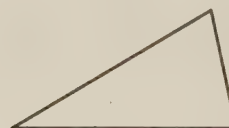
An angle smaller than a right angle.



A plane figure that forms a closed path so that all the points on the path are the same distance from a point called the center.



A triangle with three acute angles.

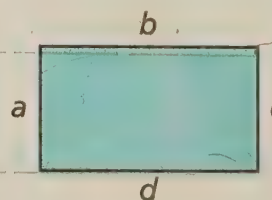


Figures that are the same size and shape.

Two sides that meet at a point.

Example:

Sides *a* and *b* are adjacent.



degree ($^{\circ}$)

**equilateral
triangle**

**diagonal of a
quadrilateral**

**intersecting
lines**

endpoint

**isosceles
triangle**

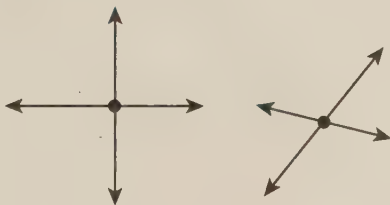
A triangle with three sides of equal length.



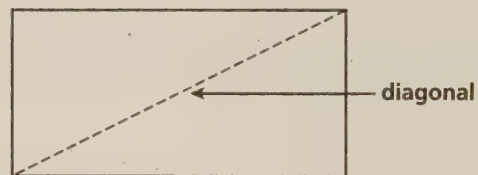
A unit for measuring angles.

Lines that meet at a point.

Examples:



A line segment that connects two opposite corners (vertices).



A triangle with at least two sides of equal length.



The point at either end of a line segment or the beginning point of a ray.



kite

line segment

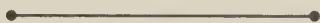
line

line symmetry

**line of
symmetry**

obtuse angle

Part of a line that has two endpoints.



A quadrilateral with two pairs of equal adjacent sides.

Examples:



A figure has line symmetry if it can be folded along a line to create two halves that match exactly.



A straight path that goes on forever in opposite directions.

Example:

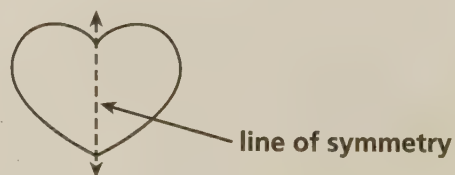
line AB



An angle greater than a right angle and less than a straight angle.



A line on which a figure can be folded so that the two halves match exactly.



obtuse triangle

parallelogram

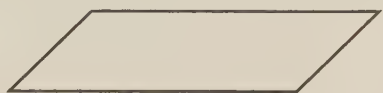
opposite sides

**perpendicular
lines**

parallel lines

point

A quadrilateral with both pairs of opposite sides parallel.



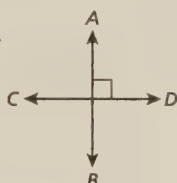
A triangle with one obtuse angle.



Lines, line segments, or rays are perpendicular if they form right angles.

Example:

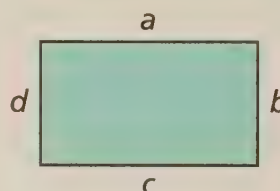
These two lines are perpendicular.



Sides that are across from each other; they do not meet at a point.

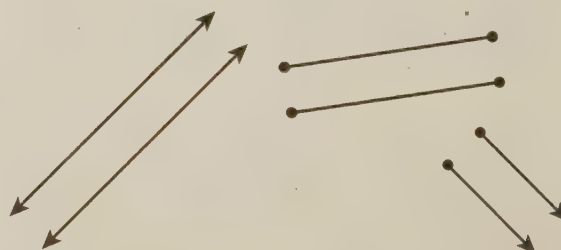
Example:

Sides *a* and *c* are opposite.



A location in a plane. It is usually shown by a dot.

Lines in the same plane that never intersect are parallel. Line segments and rays that are part of parallel lines are also parallel.



polygon

ray

protractor

reflection

quadrilateral

reflex angle

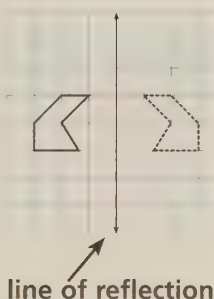
Part of a line that has one endpoint and extends without end in one direction.



A closed plane figure with sides made of straight line segments.

A flip of a figure across a line, which is called the line of reflection.

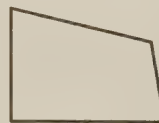
Example:



A semicircular tool for measuring and constructing angles.

An angle with a measure that is greater than 180° and less than 360° .

A polygon with four sides.



rhombus

rotation

right angle

scalene triangle

right triangle

straight angle

A turn of a figure in degrees ($^{\circ}$), either clockwise or counterclockwise.

Example:



A parallelogram with sides of equal length.



A triangle with no equal sides.



An angle that measures 90° .

An angle that measures 180° .

A triangle with one right angle.



transformation

Venn diagram

translation

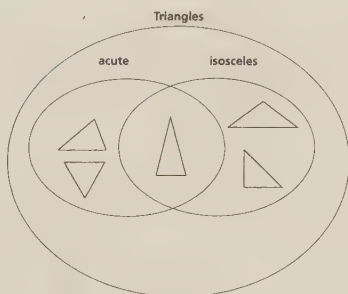
**vertex of an
angle**

trapezoid

**vertex of a
polygon**

A diagram that uses circles or other shapes to show how sets are related.

Example:



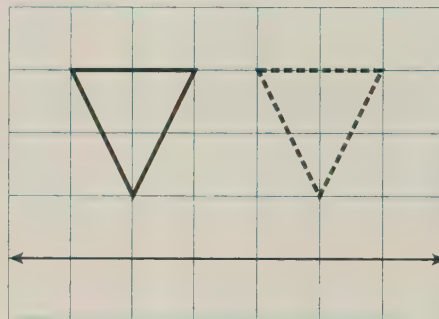
A change in the position of a figure. Rotations, reflections, and translations are types of transformations.

A point that is shared by two sides of an angle.



A slide of a figure. Each point of the figure moves the same distance in the same direction.

Example:



A point that is shared by two sides of a polygon.



A quadrilateral with exactly one pair of parallel sides.



Points, Lines, and Line Segments

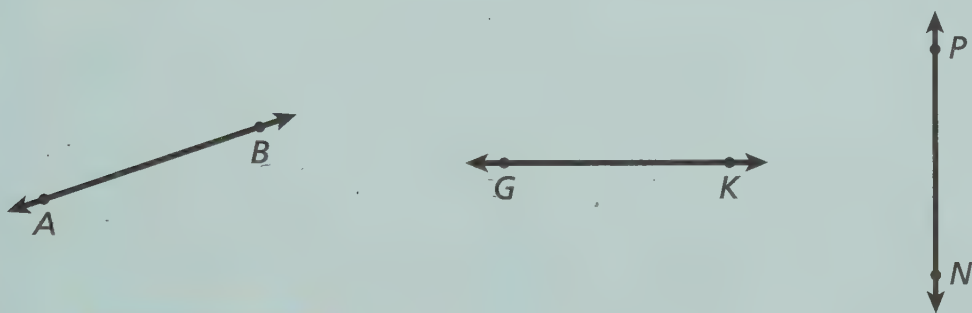
VOCABULARY

point
line
line segment
endpoint

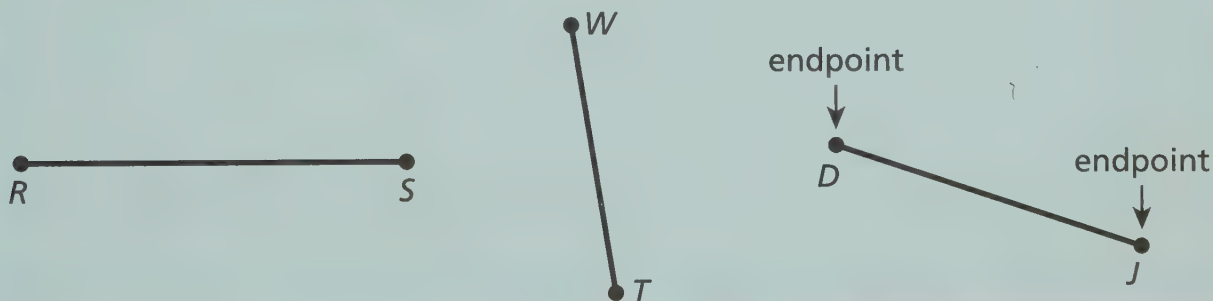
A **point** is shown by a dot. It is named by a capital letter.

• X

A **line** is a straight path that goes on forever in both directions. When you draw a line, you put arrows on the ends to show that it goes on and on. Lines can be named by any two points on the line. Here are $\overleftrightarrow{AB}$, $\overleftrightarrow{GK}$, and $\overleftrightarrow{PN}$.



A **line segment** is part of a line. It has two ends, which are called **endpoints**. Segments are named by their endpoints. Here are $\overline{RS}$, $\overline{WT}$, and $\overline{DJ}$.



- 1 You can measure to find the length of a line segment, but you cannot measure to find the length of a line. Explain why.

Drawing Points, Rays, and Angles

An **angle** is formed by two **rays** with the same endpoint, called the **vertex**.

You can label figures with letters to name them. This is $\angle ABC$. Its rays are $\overrightarrow{BA}$ and $\overrightarrow{BC}$.

Draw and label each figure.

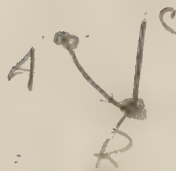
- 2 Draw and label a point. Write the name of your point. _____



- 3 Draw a ray. Label the endpoint. Write the name of your ray. _____



- 4 Draw an angle. Label the vertex and the two rays. Write the name of your angle. $\angle ABC$

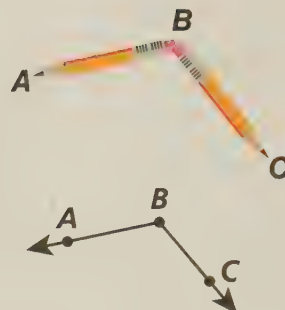


VOCABULARY

angle

ray

vertex of an angle



Discuss Angles

Angles can be many different sizes.



VOCABULARY

acute angle
right angle
obtuse angle

Discuss the groups of angles.



5 How are all of these **acute angles** alike?

6 How is an acute angle different from a **right angle**?



smaller than a right angle



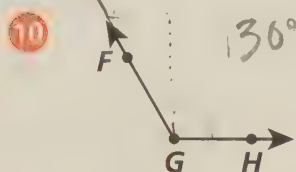
7 How are all of these **obtuse angles** alike?

8 How is an obtuse angle different from a right angle?

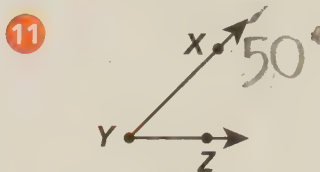
9 How is an obtuse angle different from an acute angle?

Classify Angles

Use the letters to name each angle. Then write *acute*, *right*, or *obtuse* to describe each angle.



obtuse
 $\angle FGH$

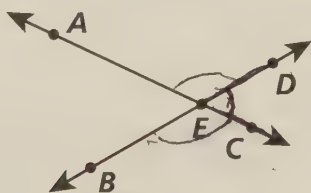


acute
 $\angle XYZ$



right
 $\angle LMN$

- 13 Use the letters to name two acute and two obtuse angles in this figure. Write *acute* or *obtuse* to describe each angle.



$\angle DEC$

acute

$\angle AED$

obtuse

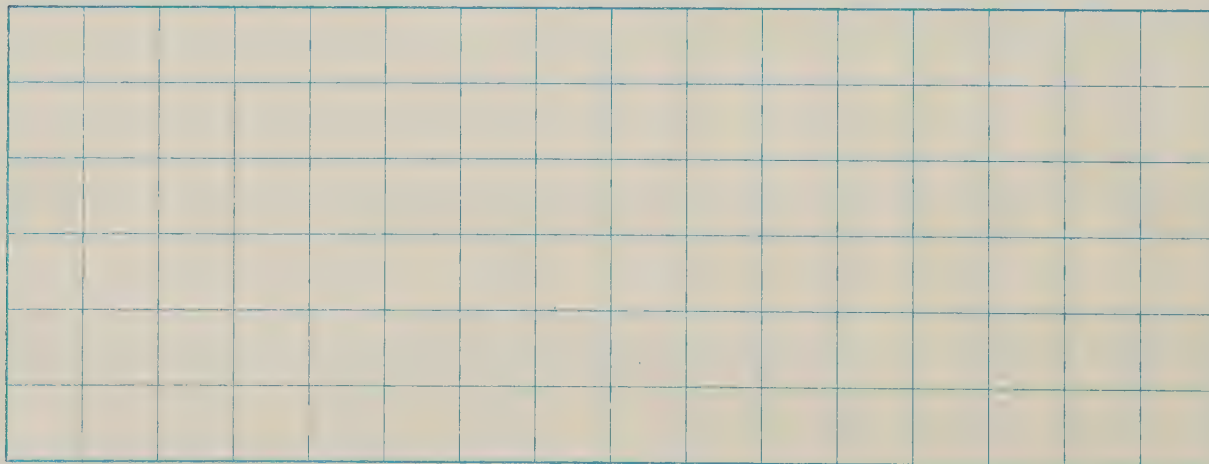
$\angle AEB$

acute

$\angle BEC$

obtuse

- 14 Draw and label a right angle, an acute angle, and an obtuse angle.

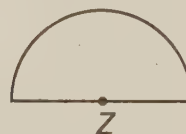
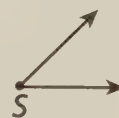
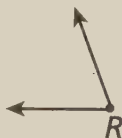
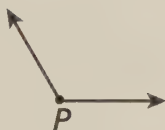
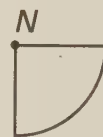
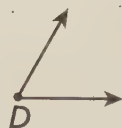
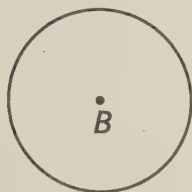


Check Understanding

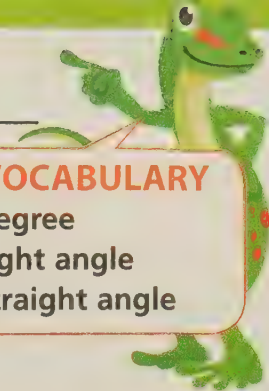
Draw and label a line, a line segment, and a ray.

Sort Angles

Cut along the dashed lines.





**VOCABULARY**

degree

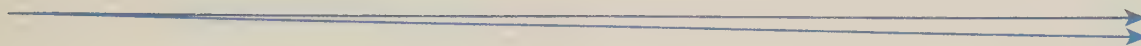
right angle

straight angle

Introduce Degrees

Angles are measured in units called **degrees**. One degree is the measure of one very small turn from one ray to the other.

This angle has a measure of 1 degree.



The measure of an angle is the total number of 1-degree angles that fit inside it.

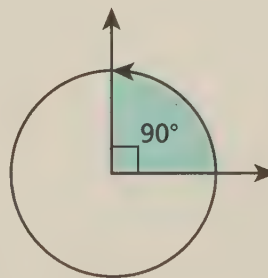
This angle measures 5 degrees.



The symbol for degrees is a small raised circle ($^{\circ}$). You can write the measure of the angle above as 5° . $5 \times 1^{\circ} = 5^{\circ}$

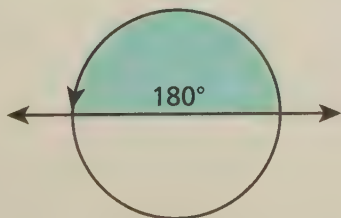
A **right angle** has a measure of 90° .

A 90° turn traces one quarter of a circle.



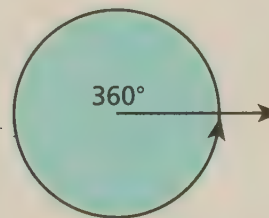
A **straight angle** measures 180° .

A 180° turn traces one half of a circle.



The angle below measures 360° .

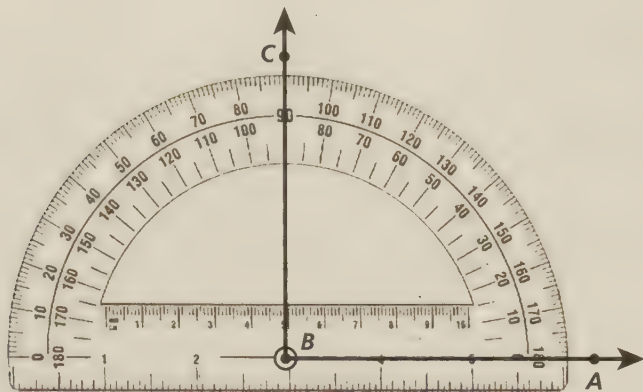
A 360° turn traces a complete circle.



Use a Protractor

VOCABULARY
protractor

A **protractor** is a tool that is used to measure angles in degrees. This protractor shows that $\angle ABC$ measures 90° .



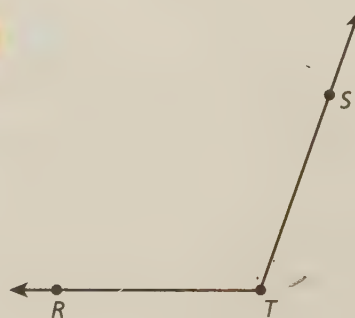
Measure each angle with your protractor. Write the measure.

1



$\angle KLM = 70$

2



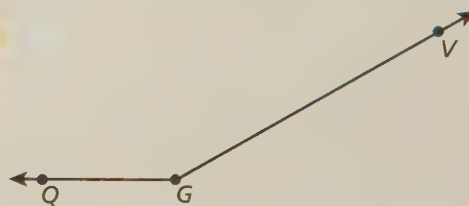
$\angle STR = 110$

3



$\angle XYZ = 130$

4

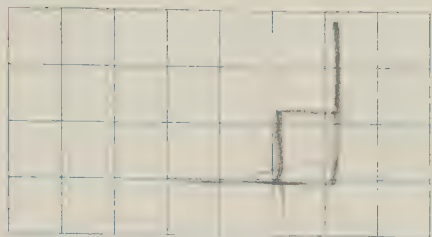


$\angle QGV = 150$

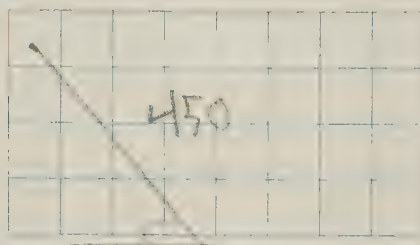
Sketch Angles

Sketch each angle, or draw it using a protractor.

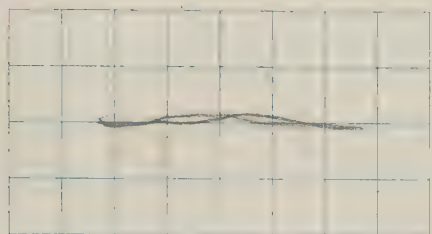
5

 90° 

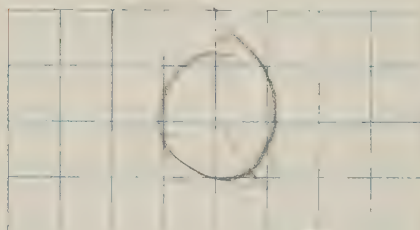
6

 45° 

7

 180° 

8

 360° 

Use Reasoning

Use the figures at the right to answer the following questions.

- 9 Name one right angle in each figure.

- 10 Name one straight angle in each figure.

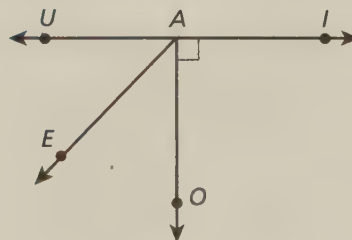
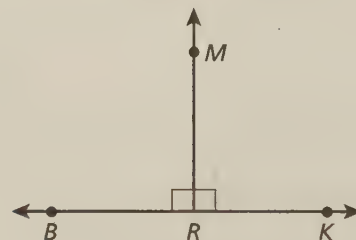
- 11 How much greater is the measure of $\angle KRB$ than the measure of $\angle IAO$?

- 12 Which angle appears to be a 45° angle?

- 13 The measure of $\angle IAE$ is 135° .

What is the measure of $\angle OAE$? _____

What is the measure of $\angle UAE$? _____



Angles in the Real World

Here is a map of Jon's neighborhood. The east and west streets are named for presidents of the United States.

The north and south streets are numbered. The avenues have letters. Jon's house is on the corner of Lincoln and First.



14 What do the arrows to the left of the map tell you?

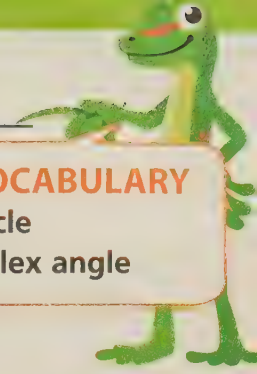
15 Jon leaves his house and rides his bike south on First. What kind of angle does he make for each turn in this route? What is the measure of each angle?

- Jon turns southeast onto Avenue A. _____
- When he reaches Washington, he turns west. _____
- When he gets back to First, he turns south. _____

16 Jon's cousin Cora leaves Jon's house and rides east on Lincoln to Avenue B. Draw the angle Cora makes if she turns southeast. What is the measure of the angle?

Check Understanding

Draw a 90° angle, a 135° angle, and a 180° angle.

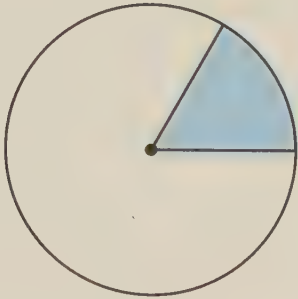
**VOCABULARY**

circle

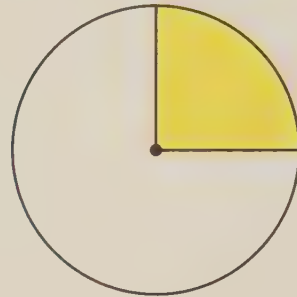
reflex angle

Measure Angles in a Circle

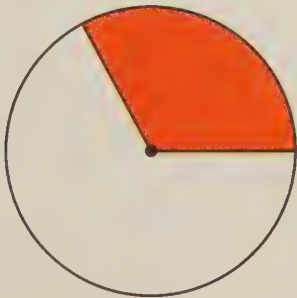
You can show all the different types of angles in a **circle**.

Acute angle

greater than 0° and less than 90°

Right angle

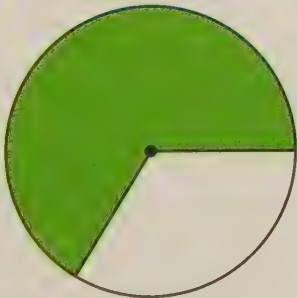
90°

Obtuse angle

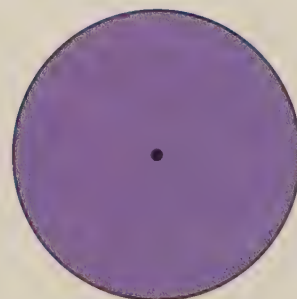
greater than 90° and less than 180°

Straight angle

180°

Reflex angle

greater than 180° and less than 360°

Circle

360°

Draw Angles in a Circle

Use a straightedge and a protractor to draw and shade an angle of each type. Measure and label each angle.

1 obtuse angle



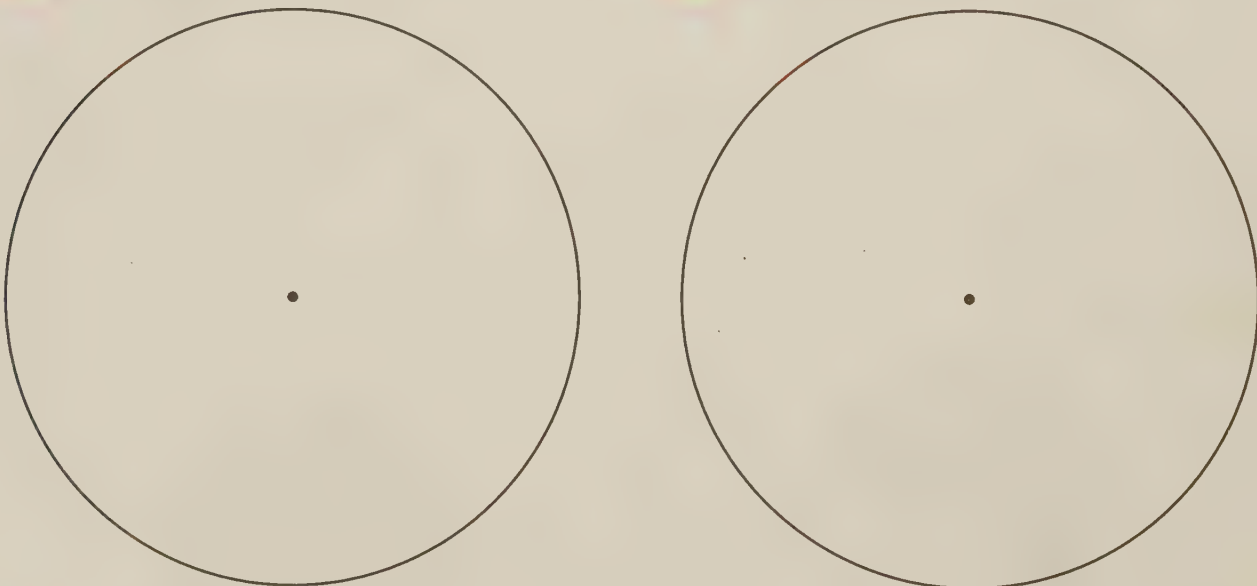
2 straight angle



3 acute angle



4 three angles with a sum of 360°

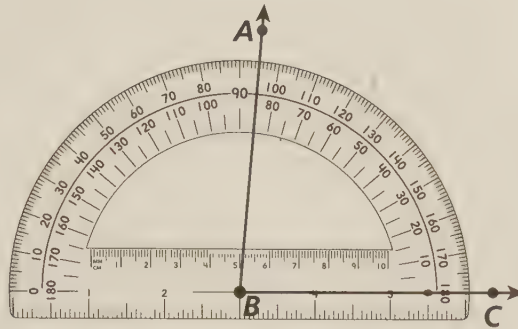


✓ Check Understanding

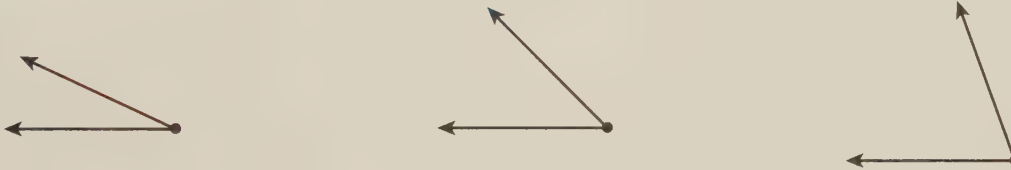
Write an addition equation that shows the sum of your angle measures in Exercise 4.

Write the correct answer.

- 1 Measure angle ABC . Tell whether it is an acute, obtuse, or right angle.



- 2 Liam sketches a 45° angle. Circle the angle Liam sketches.



Draw the figure.

- 3 Ray EF

- 4 Right angle ABC

- 5 Obtuse angle DEF

Add or subtract.

$$\begin{array}{r} 1 \quad 434 \\ + 315 \\ \hline 749 \end{array}$$

$$\begin{array}{r} 2 \quad 572 \\ - 358 \\ \hline 214 \end{array}$$

$$\begin{array}{r} 3 \quad 374,583 \\ + 44,625 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \quad 506,721 \\ - 452,899 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \quad 3,274 \\ + 835 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \quad 30,430 \\ - 18,478 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \quad 813 \\ + 526 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \quad 56,923 \\ - 7,361 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \quad 7,846 \\ - 2,515 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \quad 676 \\ - 421 \\ \hline \end{array}$$

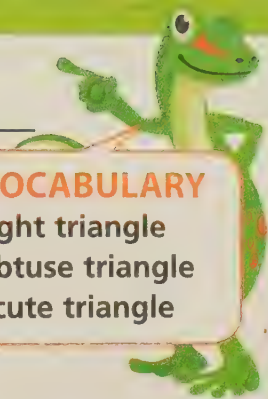
$$\begin{array}{r} 11 \quad 5,707 \\ - 2,644 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \quad 17,948 \\ + 23,324 \\ \hline \end{array}$$

$$\begin{array}{r} 13 \quad 672,943 \\ - 45,867 \\ \hline \end{array}$$

$$\begin{array}{r} 14 \quad 4,839 \\ + 6,127 \\ \hline \end{array}$$

$$\begin{array}{r} 15 \quad 67,359 \\ + 4,418 \\ \hline \end{array}$$

**VOCABULARY**

right triangle
obtuse triangle
acute triangle

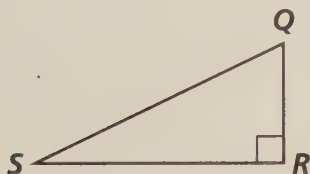
Discuss Angles of a Triangle

The prefix *tri-* means “three,” so it is easy to remember that a triangle has 3 angles. Triangles can take their names from the kind of angles they have.

- A **right triangle** has one right angle, which we show by drawing a small square at the right angle.
- An **obtuse triangle** has one obtuse angle.
- An **acute triangle** has three acute angles.



- ① You can also use letters to write and talk about triangles. This triangle is $\triangle QRS$. Name its three angles and their type.



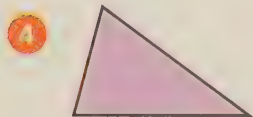
- ② What kind of triangle is $\triangle QRS$? How do you know?

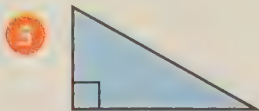
- ③ Draw and label a right triangle, an acute triangle, and an obtuse triangle.



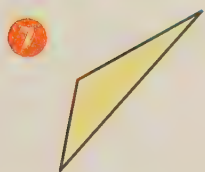
Identify Angles of a Triangle

Name each triangle by its angles. Explain your thinking.



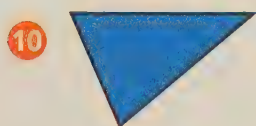






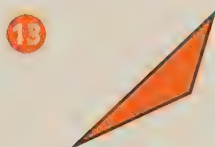
















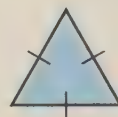
- 16 Describe how angles make triangles different from one another.

Discuss Sides of a Triangle

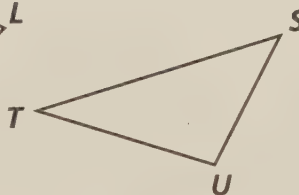
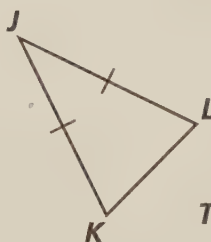
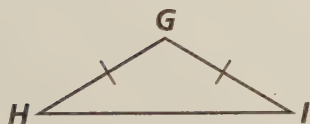
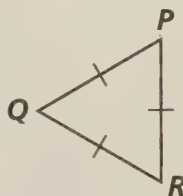
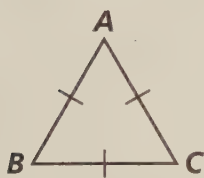
Triangles can be named by their sides. Small "tick marks" on the sides of triangles tell us when sides are equal.

- The prefix *equi-* means "equal." Triangles that have three equal sides are called **equilateral**.
- Triangles that have two equal sides are called **isosceles**. The word *isosceles* comes from very old words that mean "equal legs."
- Triangles with no equal sides are called **scalene**. All triangles that are not equilateral or isosceles are scalene.

VOCABULARY
equilateral triangle
isosceles triangle
scalene triangle



Use these triangles to answer the questions.



- 17 Write the letter names of the scalene triangles.

- 18 Write the letter names of the equilateral triangles.

- 19 Write the letter names of the isosceles triangles.

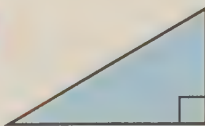
Identify Sides of a Triangle

Name each triangle by its sides. Explain your thinking.

20



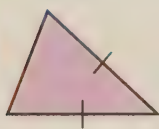
21



22



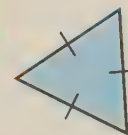
23



24



25



26



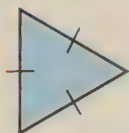
27



28



29



30



31



32 Explain how sides make triangles different from each other.

Name _____

Sort Triangles in Different Ways

- 33** Write a capital letter and a lowercase letter inside each triangle below, using the keys at the right.

Cut out the triangles and use the **Venn diagram** below to sort them in different ways.

VOCABULARY

Venn diagram

acute = a

obtuse = o

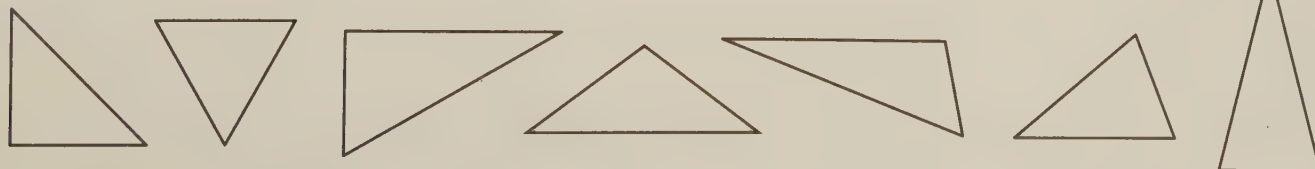
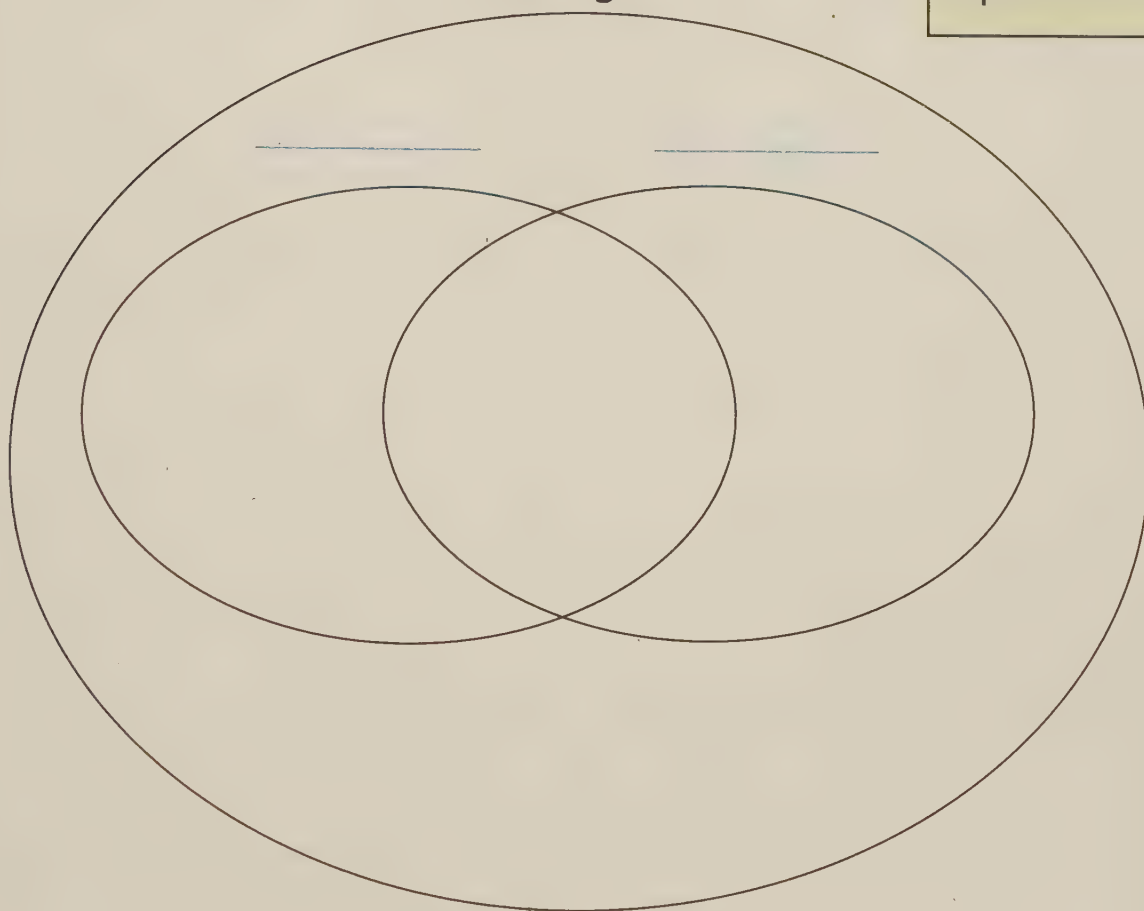
right = r

Isosceles = I

Scalene = S

Equilateral = E

Triangles



Possible Ways to Name Triangles

Draw each triangle. If you can't, explain why.

34 Draw a right scalene triangle.	35 Draw an obtuse scalene triangle.
36 Draw a right equilateral triangle.	37 Draw an acute isosceles triangle.
38 Draw an obtuse equilateral triangle.	39 Draw a right isosceles triangle.

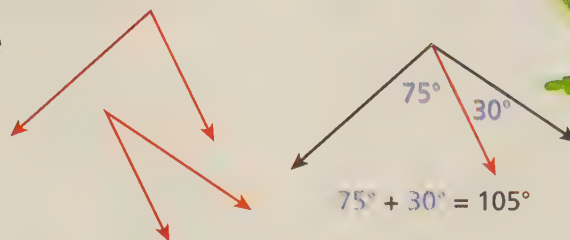
✓ Check Understanding

Name a triangle with angles measuring 45° , 45° , and 90° and two of the sides measuring 7 centimeters each.



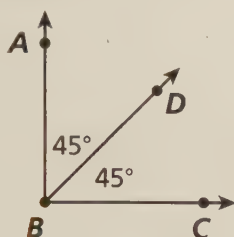
Add Angle Measures

Two angles can be put together to form another angle. The measure of the whole angle is the sum of the measures of the smaller angles. The measure of the whole angle shown is 105° .

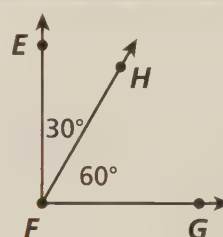


What kind of angle is formed when the two angles are put together? What is its measure?

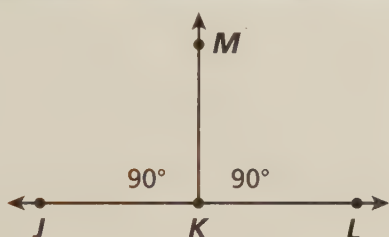
1



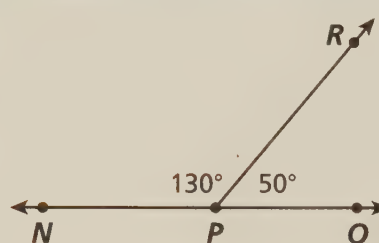
2



3



4

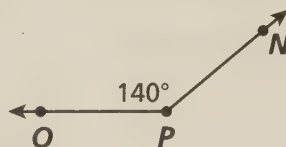
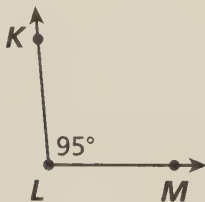
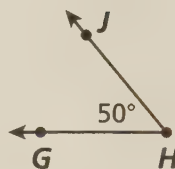
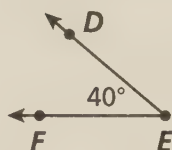
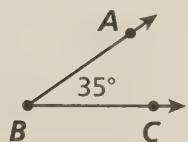


- 5 An angle is made from two angles with measures 80° and 70° . Write and solve an equation to find the measure of the whole angle.

Show your work.

Put Angles Together

Use the angles shown to make other angles.



- 6 Which two angles would you put together to make a 75° angle?

- 7 Which two angles would you put together to make a 145° angle?

- 8 Which two angles would you put together to make a straight angle?

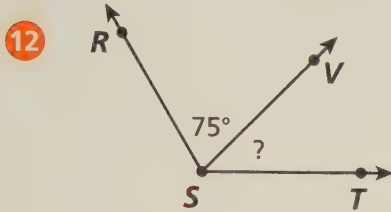
- 9 Which two angles would you put together to make a right angle?

- 10 If you put all five angles together, what would be the measure of the whole angle? What kind of figure would you form?

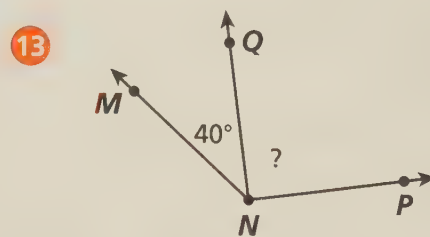
- 11 Use a protractor and straightedge to draw the angle formed by putting $\angle ABC$ and $\angle KLM$ together. Show its measure.

Subtract Angle Measures

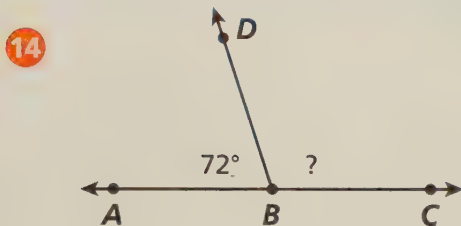
Write an equation to find the unknown angle measure.



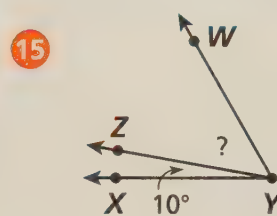
The measure of $\angle RST$ is 120° .
What is the measure of $\angle VST$?



The measure of $\angle MNP$ is 130° . What
is the measure of $\angle QNP$?



The measure of $\angle ABC$ is 180° .
What is the measure of $\angle DBC$?



The measure of $\angle XYW$ is 60° .
What is the measure of $\angle ZYW$?

- 16 Draw your own angle problem and share it with a partner.

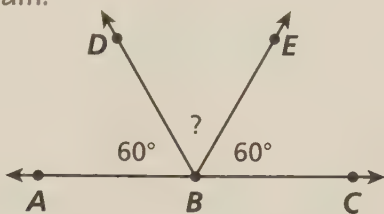
- 17 When a right angle is made from two smaller angles, what must be true about the smaller angles?

- 18 When a straight angle is made from two smaller angles, what must be true about the smaller angles?

What's the Error?

Dear Math Students,

I want to find the measure of $\angle DBE$ in the following diagram.



I wrote and solved this equation.

$$180^\circ - (60^\circ + 60^\circ) = x$$

$$180^\circ - 60^\circ + 60^\circ = x$$

$$120^\circ + 60^\circ = x$$

$$180^\circ = x$$

This answer doesn't make sense.

Did I do something wrong?

Your friend,

Puzzled Penguin



19 Write a response to Puzzled Penguin.

Check Understanding

Explain how to use an equation to find an unknown angle measure.



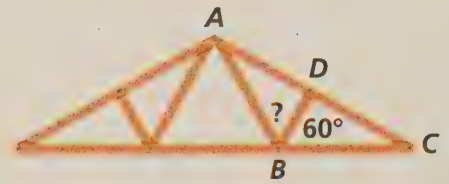
Add Angle Measures

Use an equation to solve.

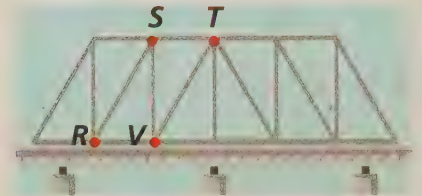
- 1 The ski jumper shown makes angles with her skis as shown. What is the sum of the angles?



- 2 In the roof framework shown, $\angle ABD$ and $\angle DBC$ have the same measure. What is the measure of $\angle DBA$? What is the measure of $\angle ABC$?

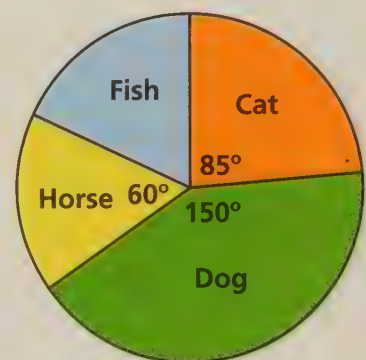


- 3 In the simple bridge structure shown, the measure of $\angle RSV$ is 30° and $\angle VST$ is a right angle. What is the measure of $\angle RST$?



The circle at the right represents all of the students in a class. Each section represents the students in the class who chose a certain type of animal as their favorite type of pet. The angle measures for some sections are given.

- 4 What is the sum of the angle measures for Cat, Dog, and Horse?

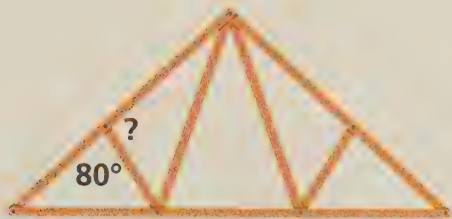


- 5 What is the total angle measure for the circle? What is the angle measure for Fish?

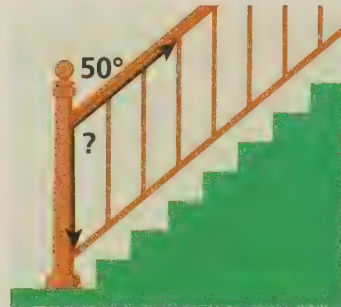
Subtract Angle Measures

Use an equation to solve.

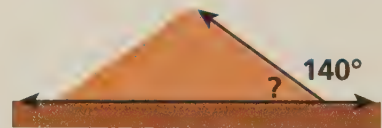
- 6 In the roof framework shown, the measure of one angle is 80° . What is the unknown angle measure?



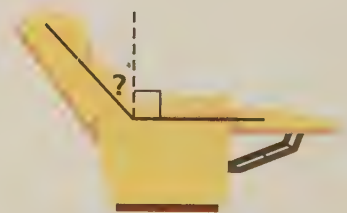
- 7 The railing on a stairway makes a 50° angle with the upright post. What is the unknown angle measure in the diagram?



- 8 When different items are poured, they form a pile in the shape of a cone. The diagram shows a pile of sand. What is the angle the sand makes with the ground?



- 9 In a reclining chair, you can push back from an upright position to sit at an angle. In the chair shown, the whole angle between the back of the chair and the seat of the chair is 130° . Find the unknown angle measure to find by how much the chair is reclined from upright.

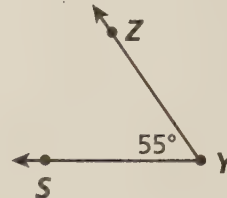
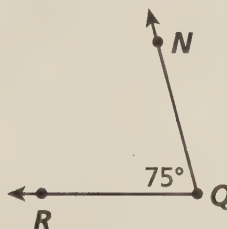
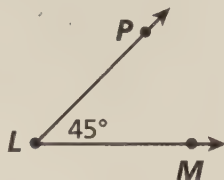
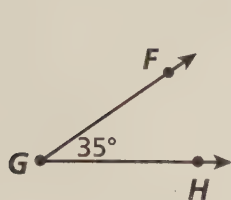


✓ Check Understanding

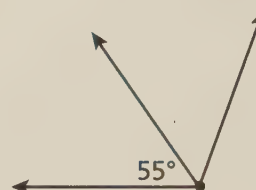
Give an example from your home, classroom, or neighborhood where you could use an equation to find an unknown angle measure.

Write the correct answer.

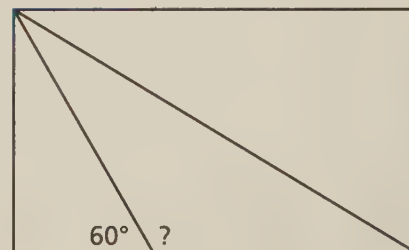
- 1 Which three angles can be put together to make a 165° angle?



- 2 Jeri measures one of two equal angles in the figure shown. Write an addition equation to find the sum of the angles.



- 3 In the window design shown, the measure of one angle is 60° . Write a subtraction equation to find the unknown angle measure.



Name the triangle by its angles.

4



5



Add or subtract.

$$\begin{array}{r} 1 \quad 1,573 \\ + 3,684 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \quad 6,345 \\ - 4,114 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \quad 32,583 \\ - 24,392 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \quad 428 \\ + 361 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \quad 719 \\ - 483 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \quad 7,832 \\ + 556 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \quad 78,362 \\ + 14,839 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \quad 3,450 \\ - 2,137 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \quad 273 \\ + 825 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \quad 889 \\ - 523 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \quad 387,387 \\ + 126,836 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \quad 20,000 \\ - 4,357 \\ \hline \end{array}$$

$$\begin{array}{r} 13 \quad 708,427 \\ - 473,892 \\ \hline \end{array}$$

$$\begin{array}{r} 14 \quad 72,497 \\ + 3,538 \\ \hline \end{array}$$

$$\begin{array}{r} 15 \quad 548,702 \\ - 94,582 \\ \hline \end{array}$$

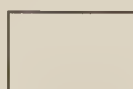
Dear Family:

Your child has been learning about geometry throughout this unit. In this second half of the unit, your child will learn to identify and draw parallel, perpendicular, and intersecting lines as well as lines of symmetry that divide a figure into two halves that match exactly. Your child will be learning how to recognize and describe a group of geometric figures called quadrilaterals, which get their name because they have four (*quad-*) sides (*-lateral*). Six different kinds of quadrilaterals are shown here.



Square

4 equal sides
opposite sides parallel
4 right angles



Rectangle

2 pairs of parallel sides
4 right angles



Rhombus

4 equal sides
opposite sides parallel



Parallelogram

2 pairs of parallel sides



Trapezoid

exactly 1 pair of
opposite sides parallel



Kite

2 pairs of equal
adjacent sides

The unit concludes with exploring how figures, including quadrilaterals, can be rotated (turned), reflected (flipped), or translated (slid) to prove that they are the same size and shape and are congruent.

If you have any questions or comments, please contact me.

Sincerely,
Your child's teacher

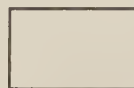
Estimada familia:

Durante esta unidad, su niño ha estado aprendiendo acerca de geometría. En esta parte de la unidad, su niño aprenderá a identificar y dibujar líneas paralelas, perpendiculares y secantes así como líneas de simetría que dividen una figura en dos mitades exactas. Su niño aprenderá cómo reconocer y describir un grupo de figuras geométricas llamadas cuadriláteros, que reciben ese nombre porque tienen cuatro (*quadri-*) lados (*-lateris*). Aquí se muestran seis tipos de cuadriláteros:



Cuadrado

4 lados iguales
lados opuestos paralelos
4 ángulos rectos



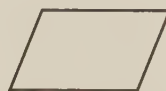
Rectángulo

2 pares de lados
paralelos
4 ángulos rectos



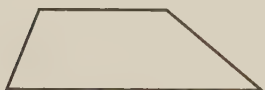
Rombo

4 lados iguales
lados opuestos paralelos



Paralelogramo

2 pares de lados paralelos



Trapecio

exactamente 1 par de
lados paralelos opuestos



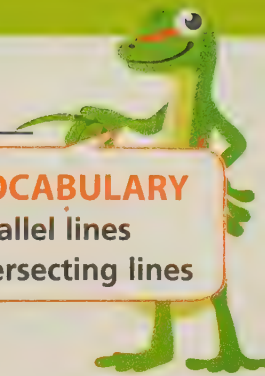
Cómete

2 pares de lados
adyacentes iguales

La unidad concluye con la exploración de cómo las figuras, incluyendo los cuadriláteros, pueden girar (rotar), reflejar (voltar) o trasladar (deslizar) para probar que son del mismo tamaño y forma, y son congruentes.

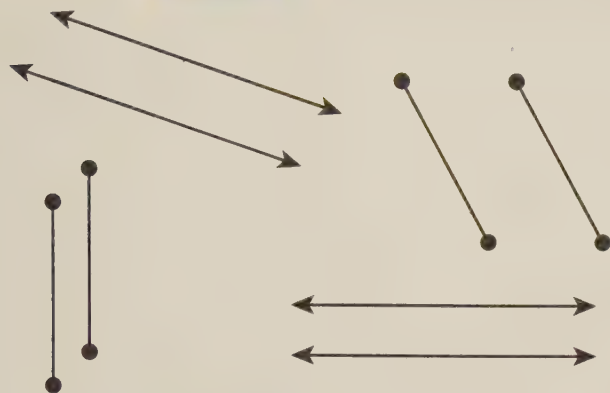
Si tiene alguna pregunta o algún comentario, por favor comuníquese conmigo.

Atentamente,
El maestro de su niño

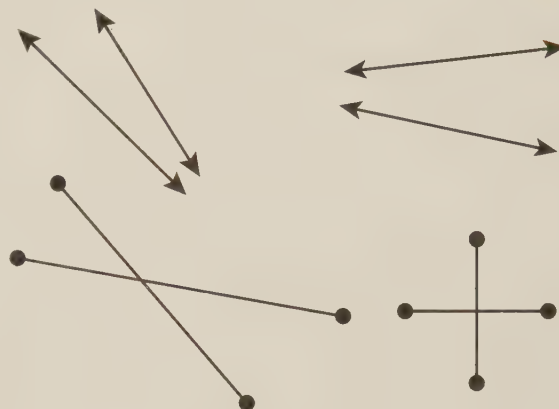


Define Parallel Lines

The lines or line segments in these pairs are **parallel**.



The lines or line segments in these pairs are not parallel.



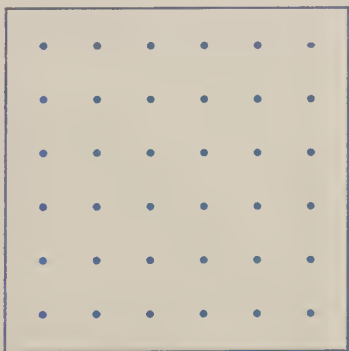
Intersecting lines meet at a point.

- 1 What do you think it means for two lines to be parallel?

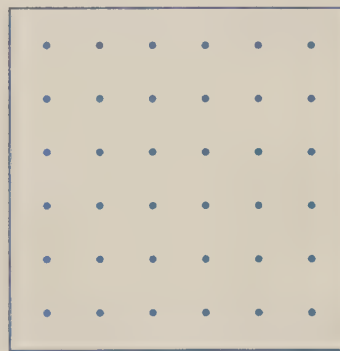
- 2 If two lines are parallel, can they ever be intersecting? _____

Draw Parallel Lines

- 3 Draw and label a pair of parallel lines.

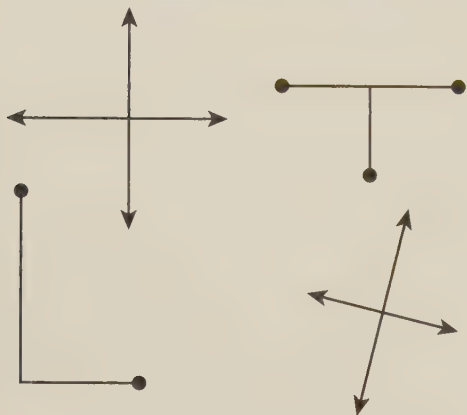


- 4 Draw and label a figure with one pair of parallel line segments.



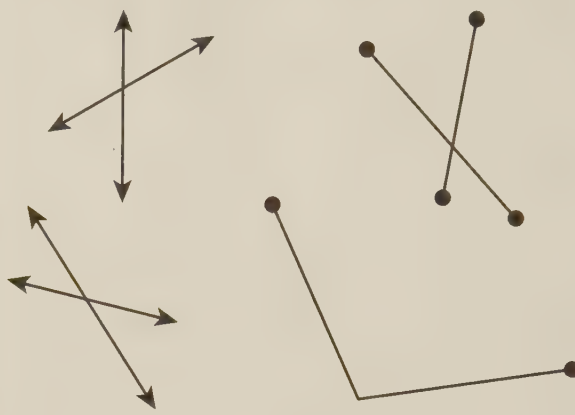
Define Perpendicular Lines

The lines or line segments in these pairs are **perpendicular**.



VOCABULARY
perpendicular lines

The lines or line segments in these pairs are not perpendicular.



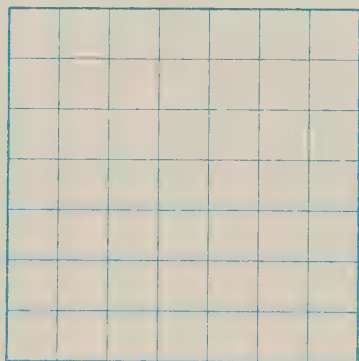
- 5 What do you think it means for two lines to be perpendicular?

- 6 If two lines are perpendicular, will they always be intersecting? _____

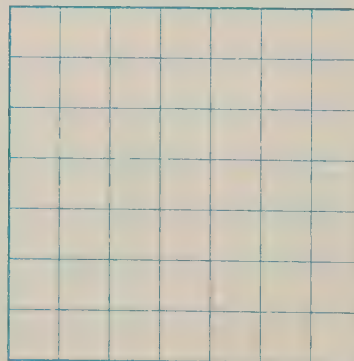
- 7 Are all intersecting lines perpendicular? _____

Draw Perpendicular Lines

- 8 Draw and label a pair of perpendicular lines.



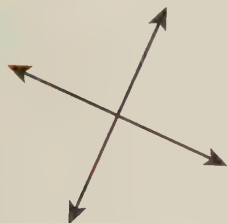
- 9 Draw and label a figure with one pair of perpendicular line segments.



Identify Types of Lines

Tell whether each pair of lines is *parallel*, *perpendicular*, or *neither*.

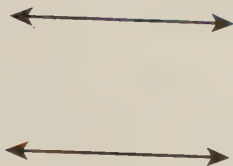
10



11



12



13



14 Draw a pair of parallel line segments.

15 First, draw a line segment 3 centimeters long. Then, draw a line segment 6 centimeters long that looks perpendicular to your first line segment.

Line Segments on a Map

Use the map.



- 16** On Wednesday, Del leaves his house and walks West along Lincoln Street. Gigi leaves her house and walks East along Jefferson Street. What kind of line segments are Lincoln Street and Jefferson Street?
-
- 17** Will Del and Gigi ever meet? If so, where?
-
- 18** On Friday, Del leaves his house and walks South along Fifth Street. Gigi leaves her house and walks East along Jefferson Street. What kind of line segments are Fifth Street and Jefferson Street?
-
- 19** Will Del and Gigi ever meet? If so, where?
-

✓ Check Understanding

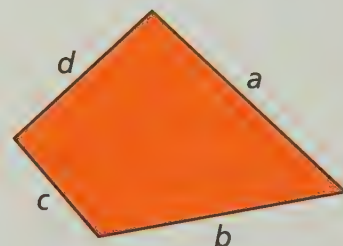
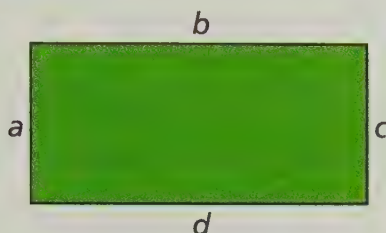
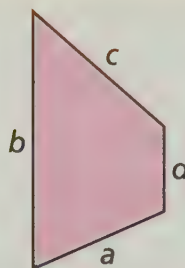
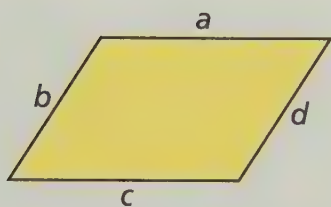
Explain how to decide whether two lines are *parallel*, *perpendicular*, or *neither*.

Identify Sides of Quadrilaterals

Look at these **quadrilaterals**.

VOCABULARY

quadrilateral
adjacent sides
opposite sides



In all of the quadrilaterals, the sides labeled a and b are **adjacent** to each other. The sides labeled b and c are also adjacent to each other.

- 1 What do you think it means for two sides to be adjacent?

- 2 Which other sides are adjacent to each other?

In all of the quadrilaterals, the sides labeled a and c are **opposite** each other.

- 3 What do you think it means for two sides to be opposite each other?

- 4 Which other sides are opposite each other?

Identify Types of Quadrilaterals

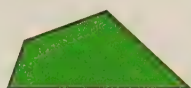
Some quadrilaterals are special because they have parallel sides or right angles. You already know about rectangles and squares. Other types of quadrilaterals are the **trapezoid**, **parallelogram**, **rhombus**, and **kite**.

You can list each type and describe its sides and angles.

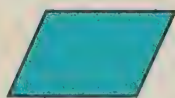
VOCABULARY

trapezoid
parallelogram
rhombus
kite

Quadrilateral: 4 sides (and 4 angles)



Parallelogram: 4 sides
2 pairs of opposite sides parallel



Trapezoid: 4 sides
exactly 1 pair of opposite sides parallel



Rhombus: 4 sides
2 pairs of opposite sides parallel
4 equal sides



Rectangle: 4 sides
2 pairs of opposite sides parallel
4 right angles



Square: 4 sides
2 pairs of opposite sides parallel
4 right angles
4 equal sides



Kite:
4 sides

2 pairs of equal adjacent sides

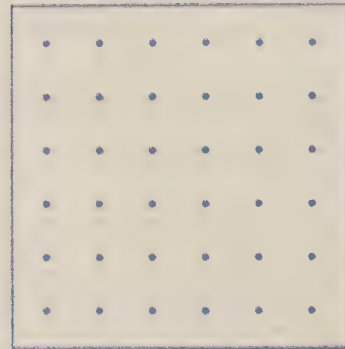


A kite can be a square or a rhombus, but not all kites are parallelograms.

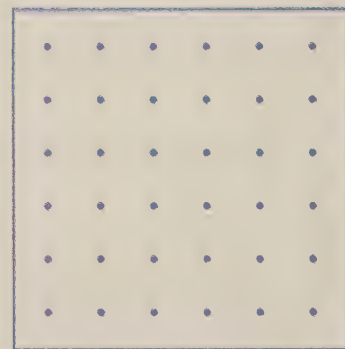
It is hard to place a kite in the table.

Draw Special Quadrilaterals

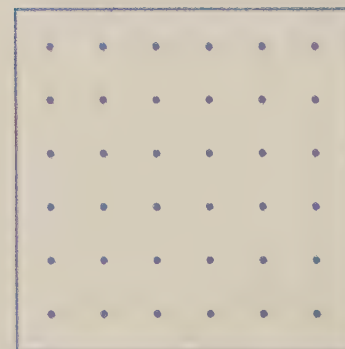
- 5 Draw a quadrilateral that has exactly one pair of opposite sides parallel. What type of quadrilateral is it?



- 6 Draw a quadrilateral that has two pairs of opposite sides parallel. What type of quadrilateral is it? Is there more than one answer?



- 7 Draw a quadrilateral that has two pairs of opposite sides parallel, 4 equal sides, and no right angles. What type of quadrilateral is it?



Identify Relationships

Why is each statement below true?

- 8 A rhombus is always a parallelogram, but a parallelogram isn't always a rhombus.

- 9 A rectangle is a parallelogram, but a parallelogram is not necessarily a rectangle.

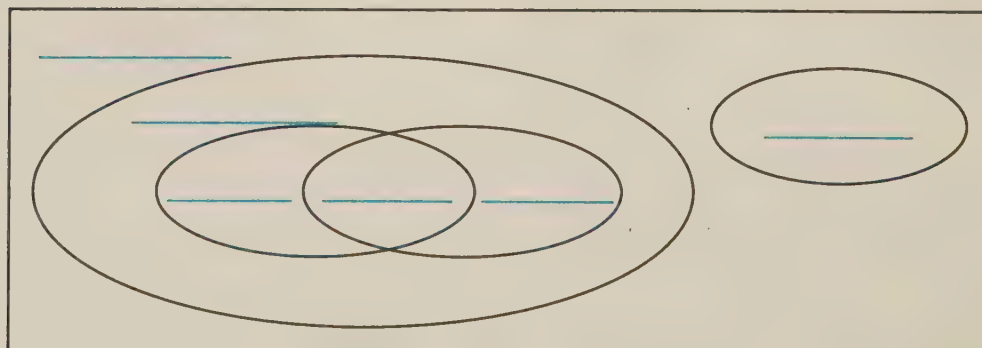
- 10 A square is a rectangle, but a rectangle does not have to be a square.

- 11 Complete the Venn diagram by placing each word in the best location.

Quadrilateral
Trapezoid

Parallelogram
Rectangle

Rhombus
Square

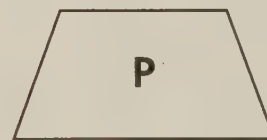
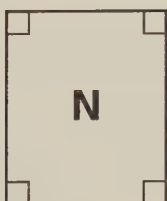
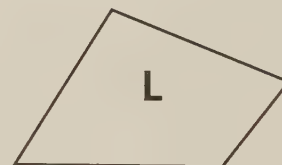
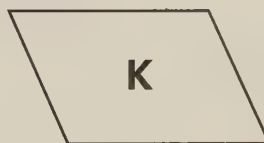
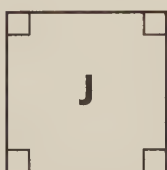
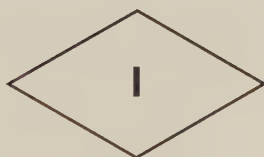
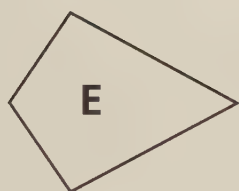
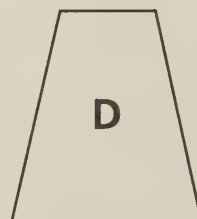
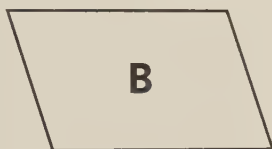
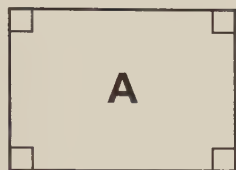


✓ Check Understanding

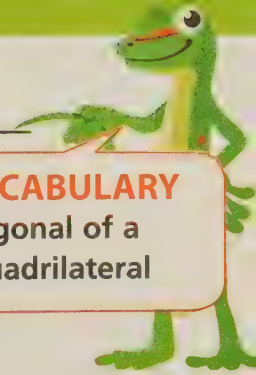
Draw a quadrilateral that is not a parallelogram.

Sort and Classify Quadrilaterals

Cut along the dashed lines.







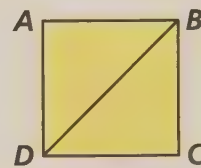
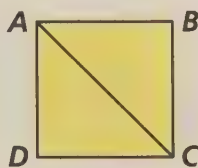
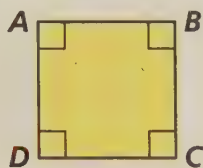
VOCABULARY
diagonal of a
quadrilateral

Use Diagonals to Make Triangles

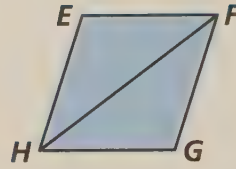
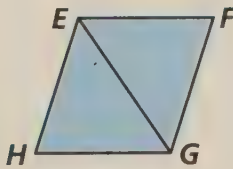
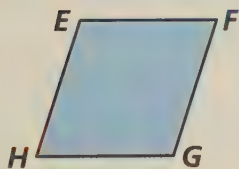
A **diagonal of a quadrilateral** is a line segment that connects two opposite corners (vertices). You can make triangles by drawing a diagonal on a quadrilateral.

List all names for each quadrilateral in Exercises 1–3. Then use letters to name the triangles you can make with the diagonals and tell what kind of triangles they are.

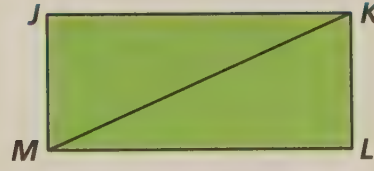
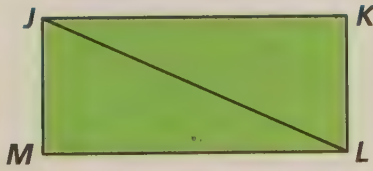
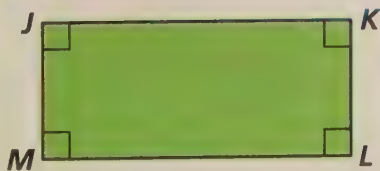
1



2

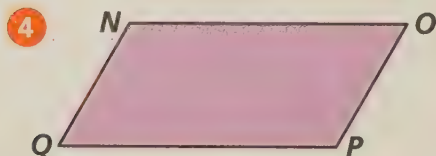


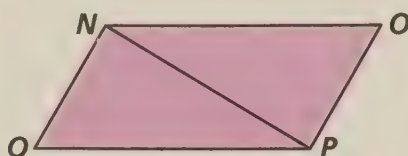
3

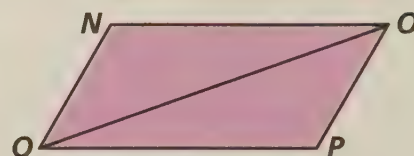


Use Diagonals to Make Triangles (continued)

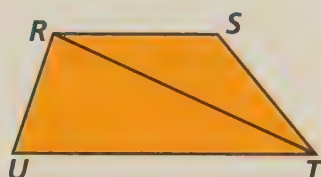
List all names for each quadrilateral in Exercises 4–6.
Then use letters to name the triangles you can make with
the diagonals and tell what kind of triangles they are.

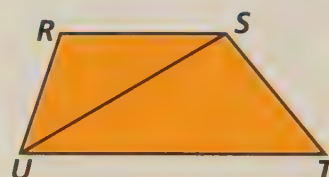


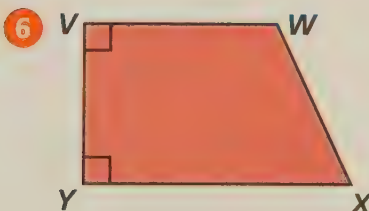


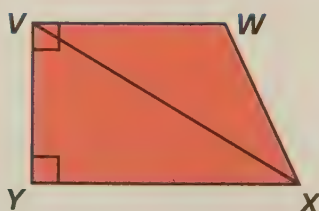


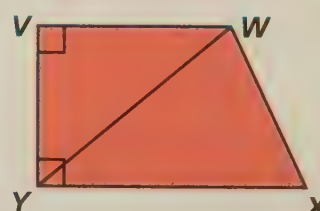






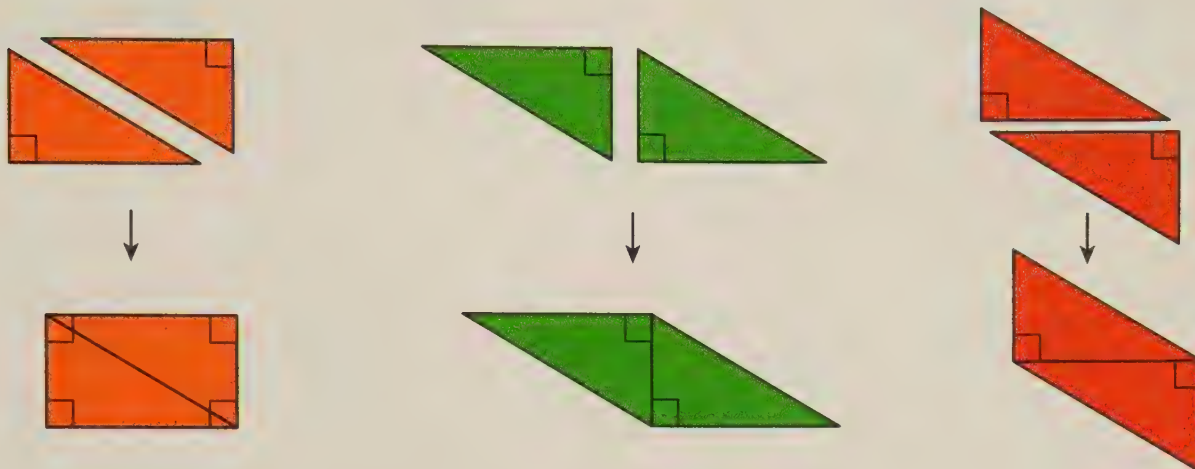






Build Quadrilaterals With Triangles

You can make a quadrilateral by joining the equal sides of two triangles that are the same size and shape.

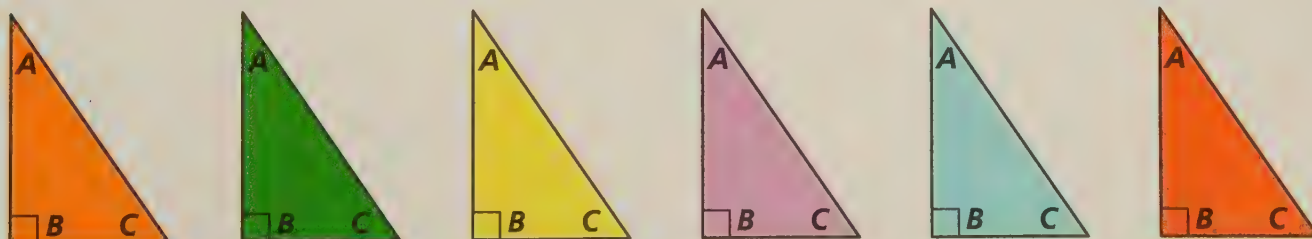


Cut out the triangles below. For each exercise, glue two of the triangles on this paper so that the stated sides are joined. Then write the name of the quadrilateral.

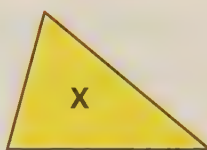
7 $\overline{AB}$ is joined to $\overline{AB}$

8 $\overline{AC}$ is joined to $\overline{AC}$

9 $\overline{BC}$ is joined to $\overline{BC}$

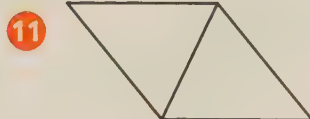


Match Quadrilaterals with Triangles



Name the triangle that is used twice to form each of the following quadrilaterals. What kind of triangle is it? Then list all names for the quadrilateral.

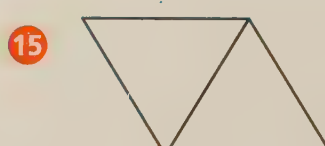












VOCABULARY

polygon

vertex of a polygon

Draw Perpendicular Lines in Triangles

A **vertex** is a point shared by two sides of a **polygon**.

Triangles are examples of polygons.

Draw a scalene triangle *ABC*.

- 16** What is true about the sides of your triangle?

- 17** Draw a segment from one vertex so that it is perpendicular to the opposite side. Label the segment and mark the right angles.

- 18** Name the triangles formed. What kind of triangles are they?

- 19** Are the triangles you formed the same size and shape?

Draw an isosceles triangle *JKL* for Exercises 20–23.

- 20** What is true about the sides of your triangle?

- 21** Draw a segment from the vertex between the equal sides of the triangle so that it is perpendicular to the opposite side. Label the segment and mark the right angles.

Draw Perpendicular Lines in Triangles (continued)

Use your isosceles triangle JKL to answer the questions.

- 22 Name the segments formed by the perpendicular segment in $\triangle JKL$. What is true about the lengths of the segments?

- 23 Name the triangles formed. Are they the same size and shape?

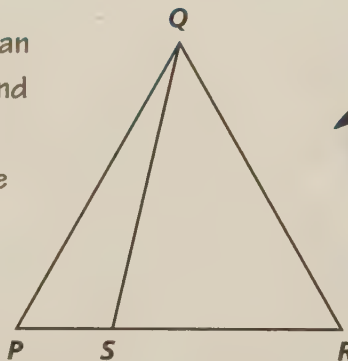
What's the Error?

Dear Math Students,

I tried to do Exercises 20–23 again using an equilateral triangle PQR . I found that $\overline{PS}$ and $\overline{RS}$ that I formed are not each half the length of side $\overline{PR}$ and the new triangles are not the same size and shape.

Did I do something wrong?

Your friend,
Puzzled Penguin



- 24 Write a response to Puzzled Penguin.

✓ Check Understanding

Complete the sentence. You can make _____ by drawing a diagonal on a quadrilateral.

Tell whether the lines are *parallel* or *perpendicular*.

1



2

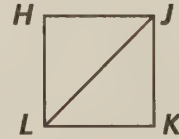
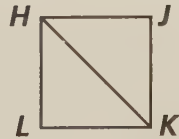


- 3 Deena draws four line segments to make a figure. The figure has two pairs of parallel sides and no right angles. What figure does Deena draw?

- 4 Gerard made a plaque. It has four sides with two pairs of equal adjacent sides. What shape is the plaque?

List all the names for the quadrilateral. Then write the type of triangles you can make with the diagonals.

5



Add or subtract.

$$\begin{array}{r} 1 \quad 1,846 \\ + 4,539 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \quad 672 \\ - 459 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \quad 38,729 \\ + 13,746 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \quad 8,695 \\ - 4,265 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \quad 475,932 \\ - 58,484 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \quad 70,007 \\ - 43,862 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \quad 348,421 \\ + 74,325 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \quad 5,016 \\ - 3,204 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \quad 783 \\ - 411 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \quad 209 \\ + 360 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \quad 62,678 \\ - 3,822 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \quad 94,327 \\ + 3,882 \\ \hline \end{array}$$

$$\begin{array}{r} 13 \quad 704,586 \\ - 479,219 \\ \hline \end{array}$$

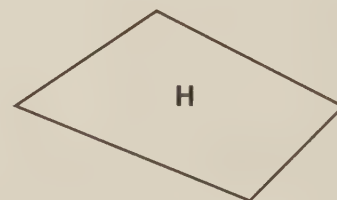
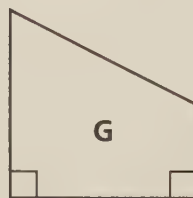
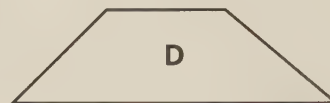
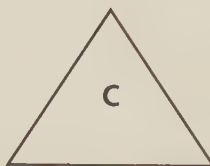
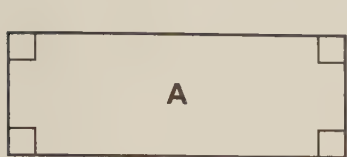
$$\begin{array}{r} 14 \quad 5,836 \\ + 816 \\ \hline \end{array}$$

$$\begin{array}{r} 15 \quad 815 \\ + 934 \\ \hline \end{array}$$



Sort Polygons by Angles

Use these polygons for Exercises 1–5.



1 Which figures have one or more acute angles?

2 Which figures have one or more right angles?

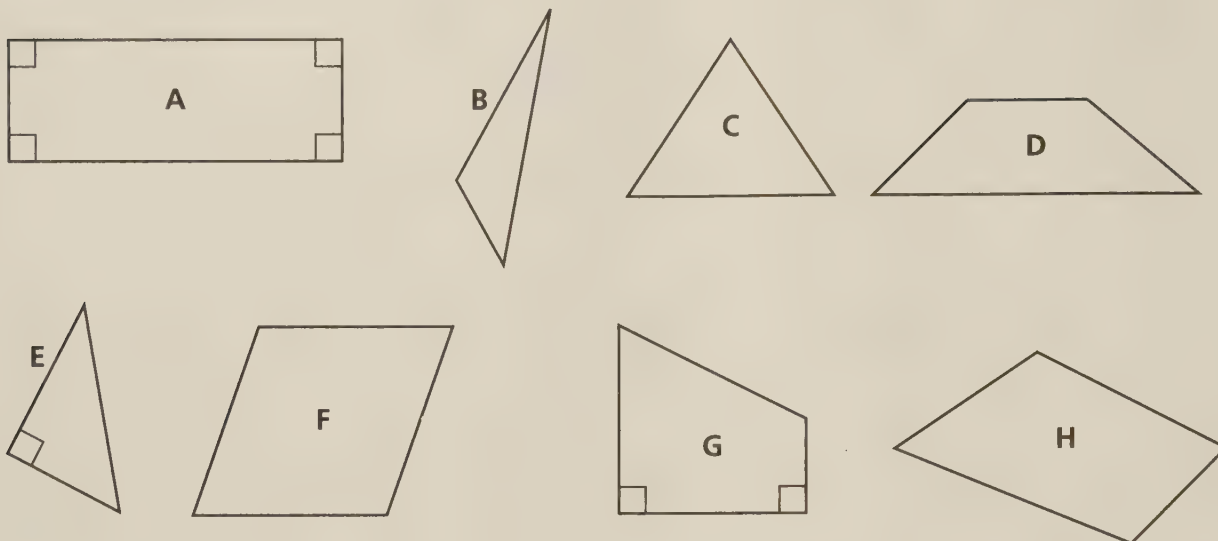
3 Which figures have one or more obtuse angles?

4 Which figures have both acute angles and right angles?

5 Which figures have both acute angles and obtuse angles?

Sort Polygons by Sides

Use these polygons for Exercises 6–10.



- 6 Which figures have perpendicular sides?

- 7 Which figures have exactly one pair of opposite sides parallel?

- 8 Which figures have two pairs of opposite sides parallel?

- 9 Which figures have both parallel and perpendicular sides?

- 10 Which figures have no parallel or perpendicular sides?

✓ Check Understanding

Give examples of ways to sort triangles and quadrilaterals.

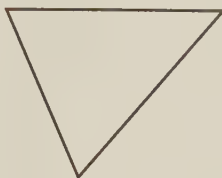
Sort Polygons Cards

Cut along the dashed lines.

A



B



C



D



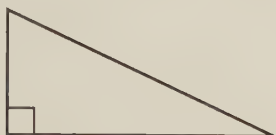
E



F



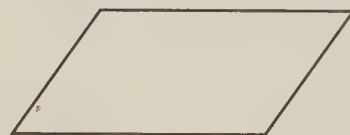
G



H



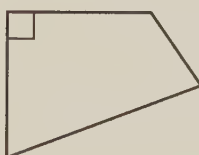
I



J



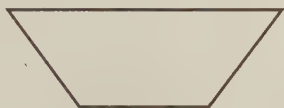
K



L



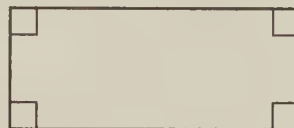
M



N



O





VOCABULARY

line symmetry

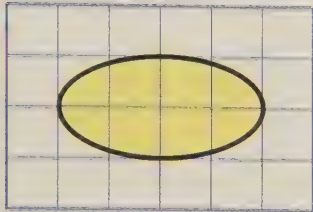
line of symmetry

Identify Line Symmetry in Figures

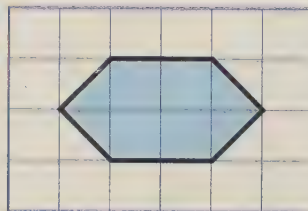
A plane figure has **line symmetry** if it can be folded along a line so the two halves match exactly. The fold is called a **line of symmetry**.

Does the figure have line symmetry? Write *yes* or *no*.

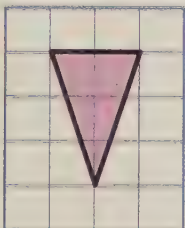
1



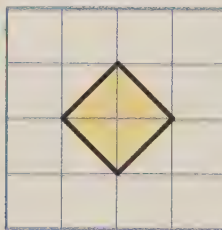
2



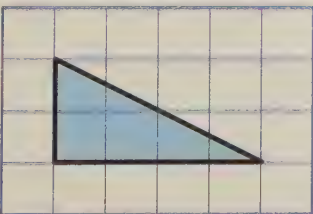
3



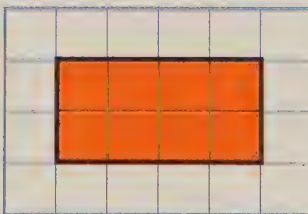
4



5

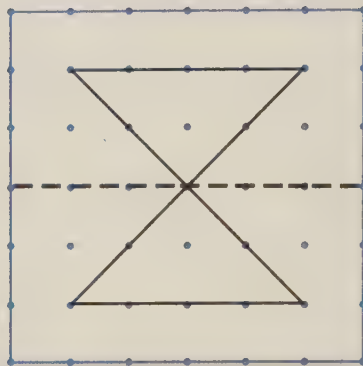
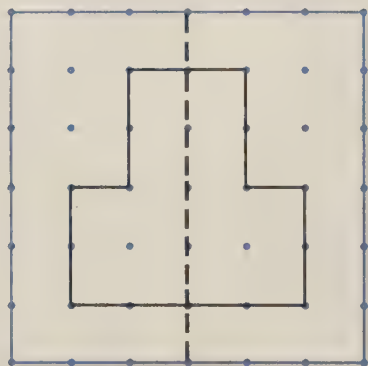


6

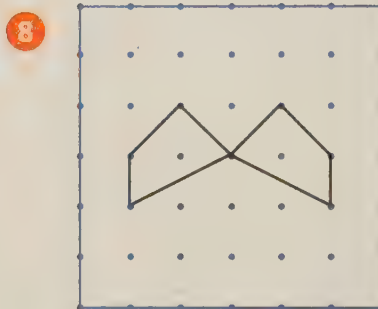
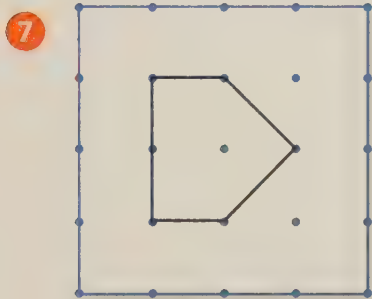


Draw Lines of Symmetry

A line of symmetry divides a figure or design into two matching parts.



Draw the line of symmetry in the figure or design.



- 9 Which figures in Exercises 1–6 have more than one line of symmetry?

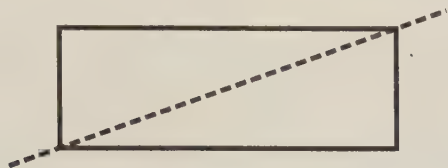
- 10 Choose one of the figures from your answer to Exercise 9. Draw the figure and draw all of its lines of symmetry.



What's the Error?

Dear Math Students,

I drew the diagonal of this rectangle as a line of symmetry.



My friend told me I made a mistake. Can you help me figure out what my mistake was?

Your friend,
Puzzled Penguin



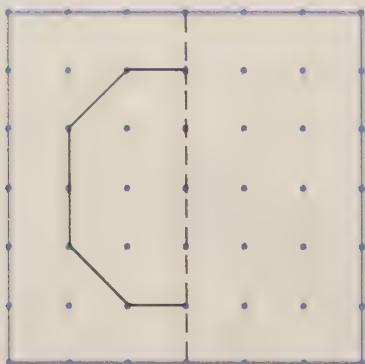
- 11** Write a response to Puzzled Penguin.

[illegible]

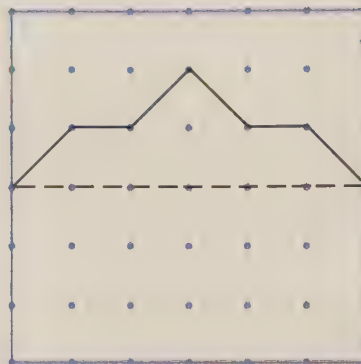
Draw the Other Half

Draw the other half of each figure to make a whole figure or design with line symmetry.

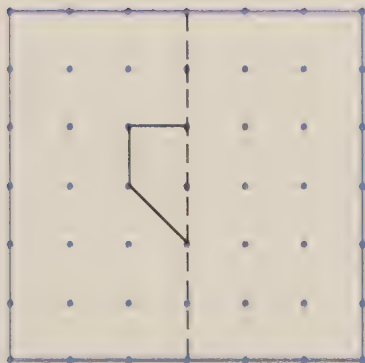
12



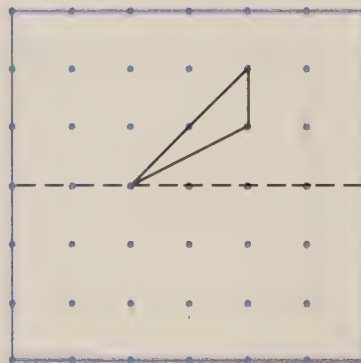
13



14



15



- 16** Copy one of your answers to Exercises 12–15 onto another piece of paper. Cut out the design and then fold it along the line of symmetry. Check that the two halves of the design match exactly.



Check Understanding

Which of your completed figures in Exercises 12–15 have more than one line of symmetry? _____



Math and Flags of the World



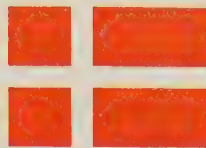
Czechia



Switzerland



South Africa



Denmark



Kuwait



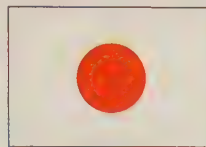
Sudan



Guyana



Paraguay



Japan



India



Bangladesh



Jamaica

Trinidad and
TobagoUnited States
of America

Laos

Flags are used in many different ways. Some sports teams use flags to generate team spirit, a flag might be used to start a race, or a homeowner might use a flag for decoration. States and countries also use flags as a representation of their communities. Each flag is different, both in color and design.

Use the designs on the flags to answer the questions.

- 1 What types of quadrilaterals are used in the Kuwait flag?

- 2 How many designs have no parallel lines? Name the flags.

- 3 How many designs have perpendicular lines? Name the flags.

- 4 Which designs have at least two lines of symmetry?

Designer Flags

Design your own flag in the space below. Your flag design should include each of the following: one triangle, one pair of parallel lines, and one 30° angle.

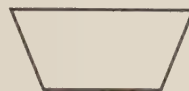
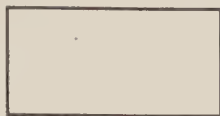


- 5 What type of triangle did you draw in your flag design? Explain how the sides of the triangle helped you classify the triangle.

- 6 Compare the flag design you made to the flag design that a classmate made. How are the two designs the same? How are they different? What shapes did you use that your classmate did not use?

Look at the figures.

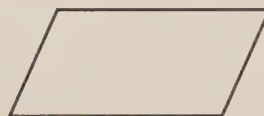
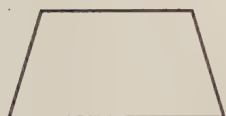
- 1 Circle the figure with obtuse angles.



- 2 Circle the figure that appears to have a right angle.



- 3 Circle the figure that appears to have perpendicular sides.



- 4 Does the figure have line symmetry?



- 5 Does the figure have line symmetry?



Add or subtract.

$$\begin{array}{r} 1 \quad 352 \\ + 337 \\ \hline \end{array}$$

$$\begin{array}{r} 2 \quad 673 \\ - 460 \\ \hline \end{array}$$

$$\begin{array}{r} 3 \quad 6,330 \\ - 4,218 \\ \hline \end{array}$$

$$\begin{array}{r} 4 \quad 722 \\ - 518 \\ \hline \end{array}$$

$$\begin{array}{r} 5 \quad 387,599 \\ + 472,850 \\ \hline \end{array}$$

$$\begin{array}{r} 6 \quad 81,275 \\ + 28,952 \\ \hline \end{array}$$

$$\begin{array}{r} 7 \quad 5,923 \\ + 6,057 \\ \hline \end{array}$$

$$\begin{array}{r} 8 \quad 8,312 \\ + 974 \\ \hline \end{array}$$

$$\begin{array}{r} 9 \quad 529 \\ + 355 \\ \hline \end{array}$$

$$\begin{array}{r} 10 \quad 40,507 \\ - 23,316 \\ \hline \end{array}$$

$$\begin{array}{r} 11 \quad 78,342 \\ - 5,761 \\ \hline \end{array}$$

$$\begin{array}{r} 12 \quad 34,809 \\ + 7,181 \\ \hline \end{array}$$

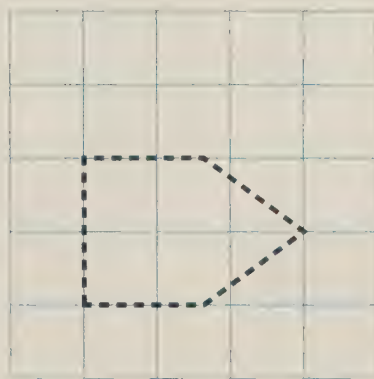
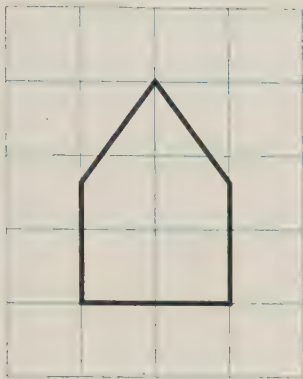
$$\begin{array}{r} 13 \quad 6,537 \\ - 3,215 \\ \hline \end{array}$$

$$\begin{array}{r} 14 \quad 349,744 \\ - 84,589 \\ \hline \end{array}$$

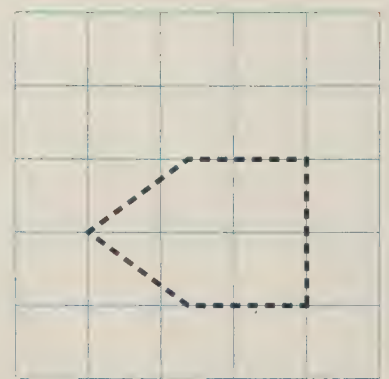
$$\begin{array}{r} 15 \quad 800,000 \\ - 526,783 \\ \hline \end{array}$$

Discuss Rotations

A **rotation** is a turn. A number of degrees ($^{\circ}$) and a direction (clockwise or counterclockwise) describe a turn.



The figure has been rotated 90° clockwise.

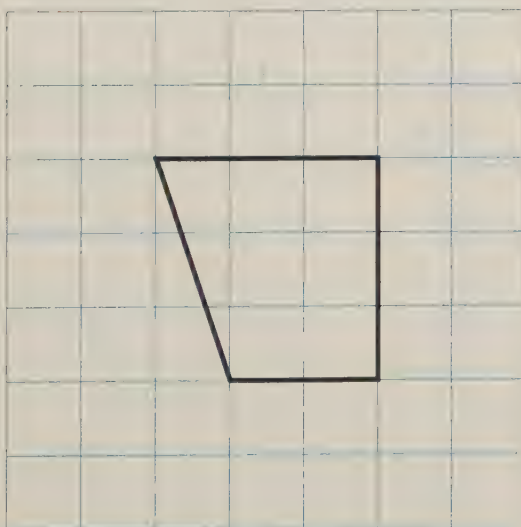


The figure has been rotated 90° counterclockwise.

Draw Rotations

Cut out the figures on page 454A. Use the cutouts to show the rotation.

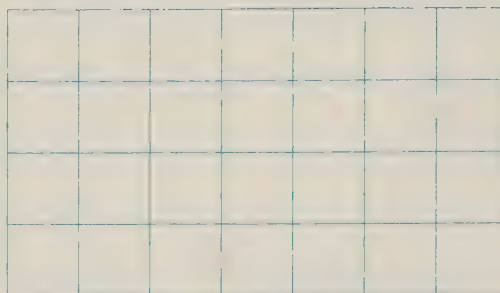
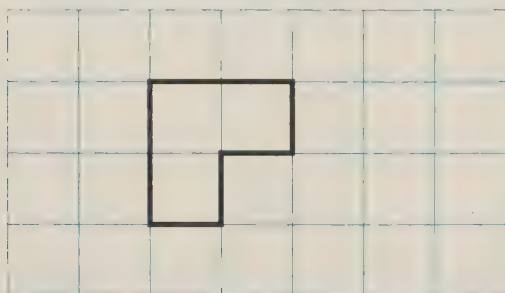
- 1 Draw a 90° clockwise rotation.



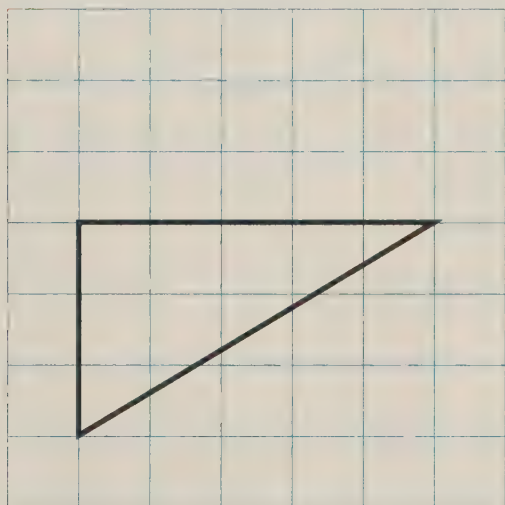
Draw Rotations (continued)

Use the cutouts to show each rotation.

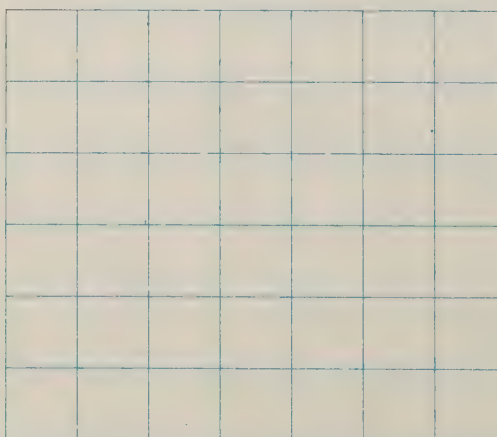
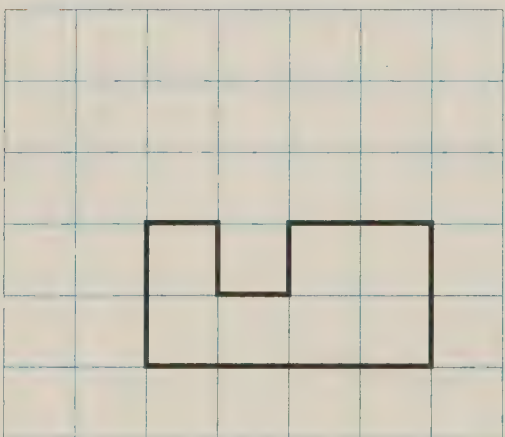
- 2 Draw a 90° counterclockwise rotation.



- 3 Draw a 90° clockwise rotation.



- 4 Draw a 90° counterclockwise rotation.



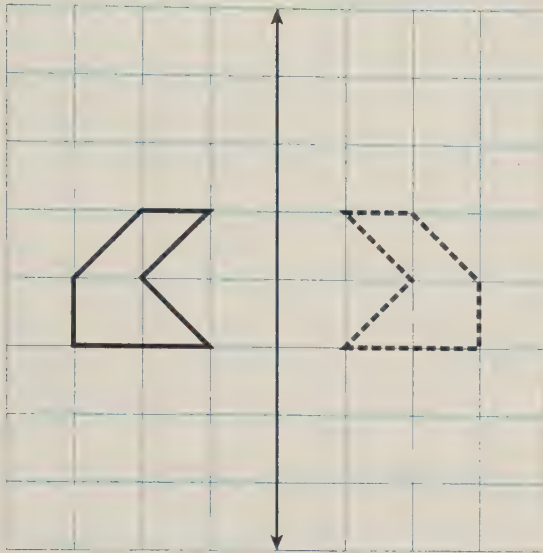
Discuss Reflections

VOCABULARY

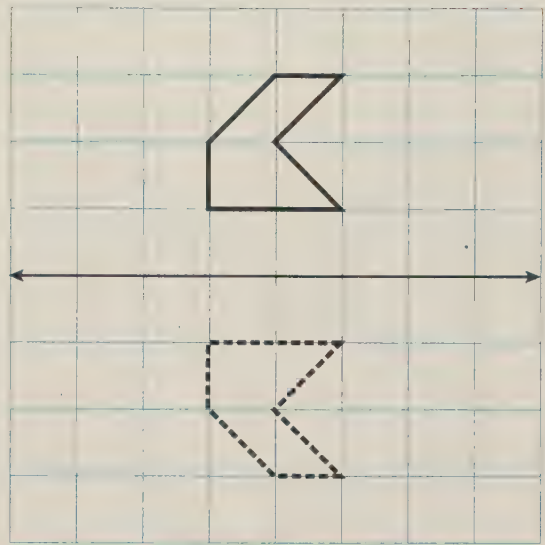
reflection

You can reflect, or flip, a figure across a line.

The line is called the line of **reflection**.



The figure on the left has been reflected over a vertical line.



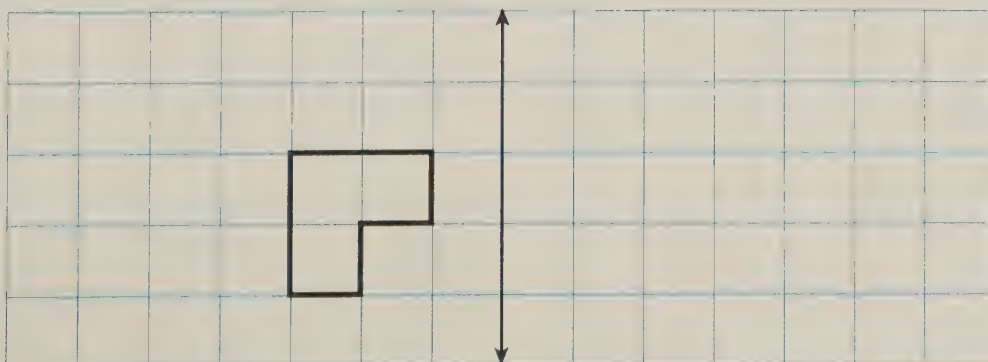
The figure on top has been reflected over a horizontal line.

- 5 What do you notice about the line in each drawing above?

Draw Reflections

Use the cutouts from page 454A to show the reflection.

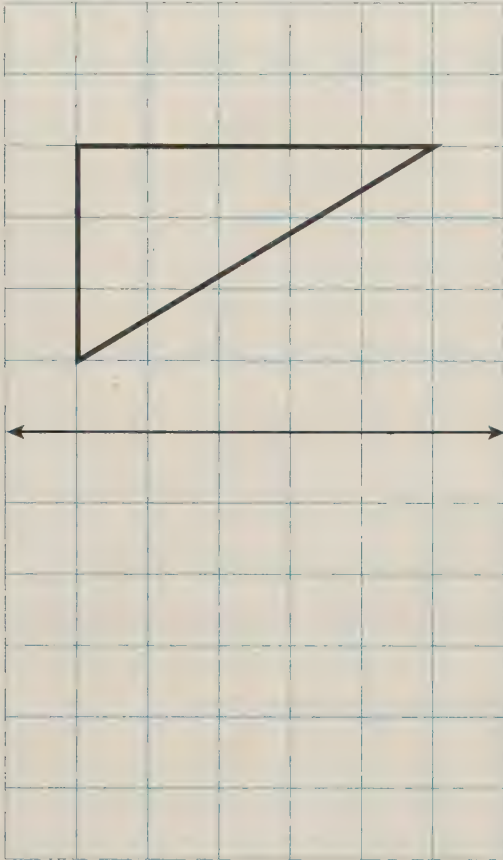
- 6 Draw a reflection over the line.



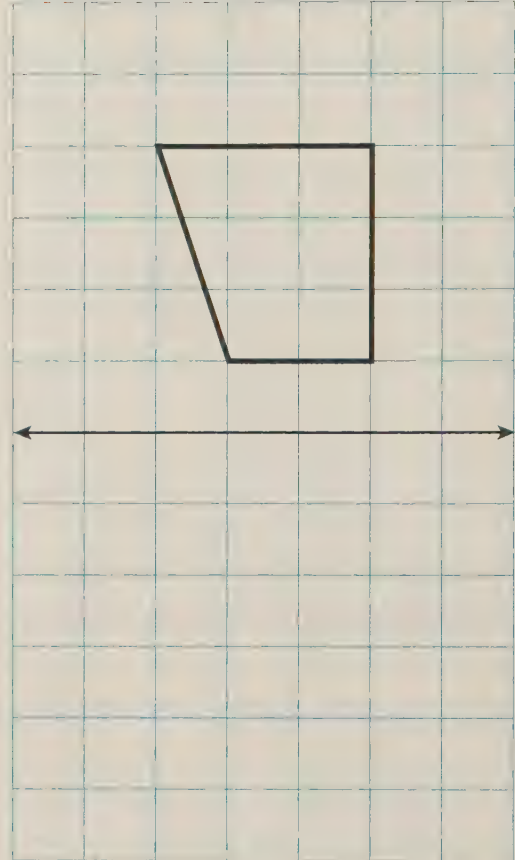
Draw Reflections (continued)

Use the cutouts to show each reflection.

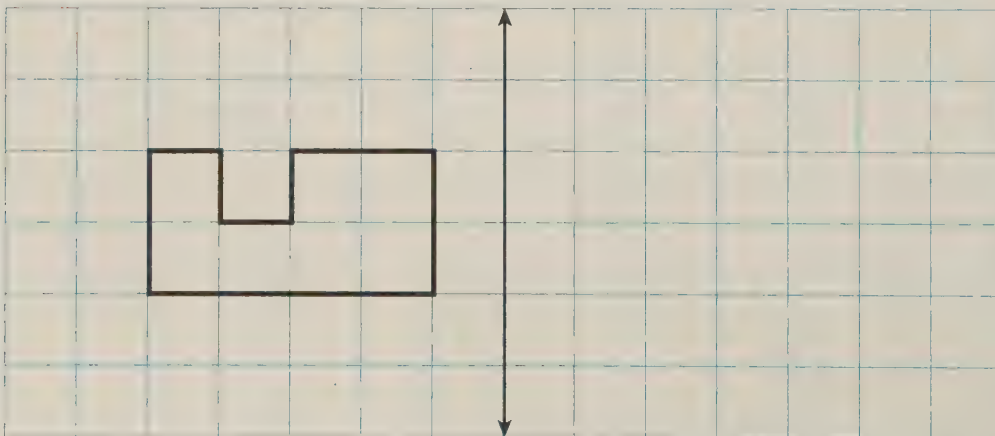
7 Draw a reflection over the line.



8 Draw a reflection over the line.



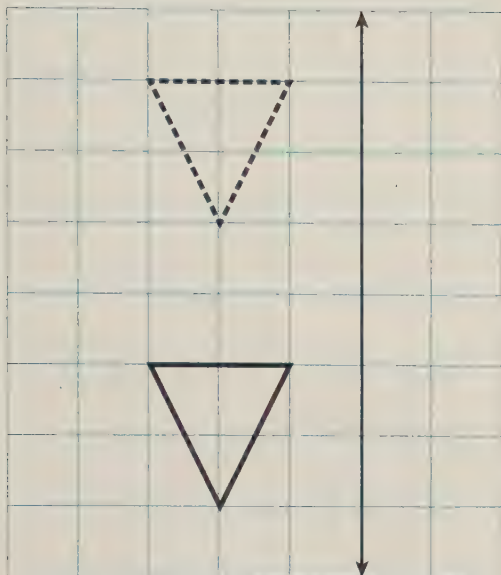
9 Draw a reflection over the line.



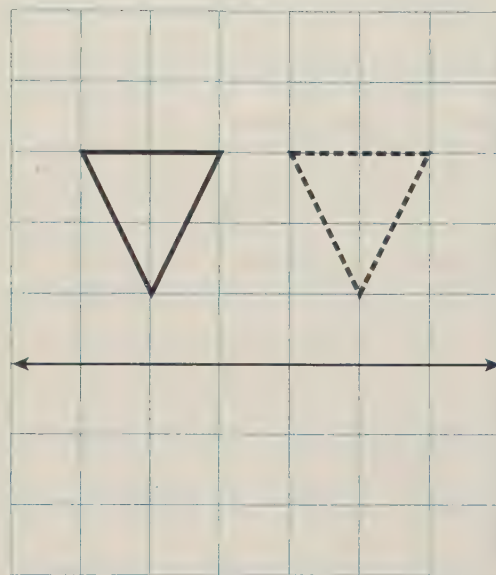
VOCABULARY
 translation

Discuss Translations

A **translation** is a slide. When a figure is translated, each of its points move the same distance in the same direction.



The figure on the bottom has been translated up along the line.

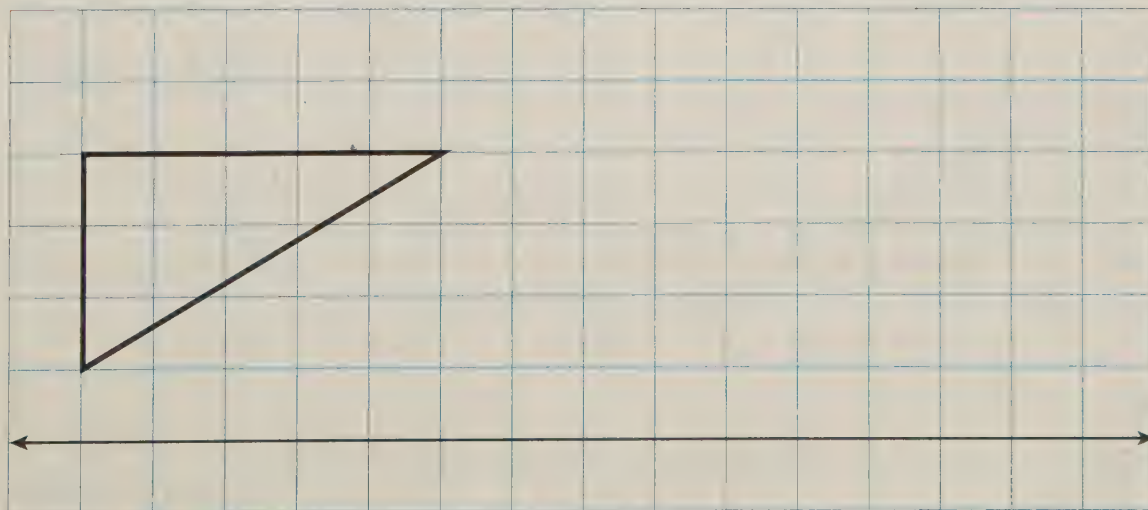


The figure on the left has been translated right along the line.

Draw Translations

Use the cutouts from page 454A to show the translation.

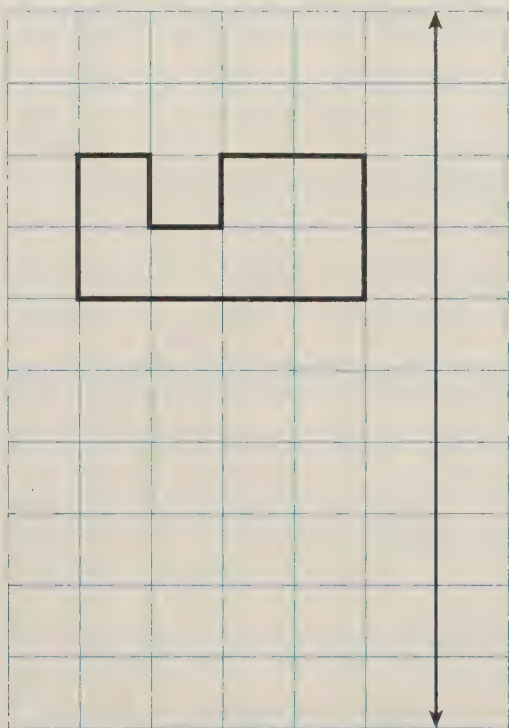
- 10 Draw a translation along the line.



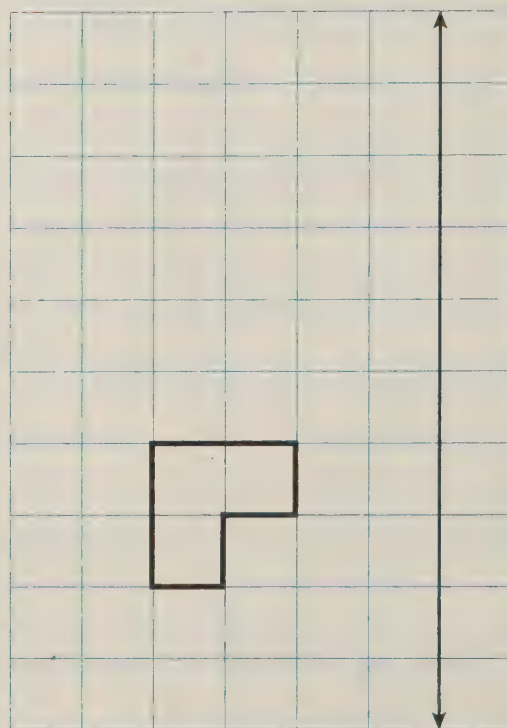
Draw Translations (continued)

Use the cutouts to show each translation.

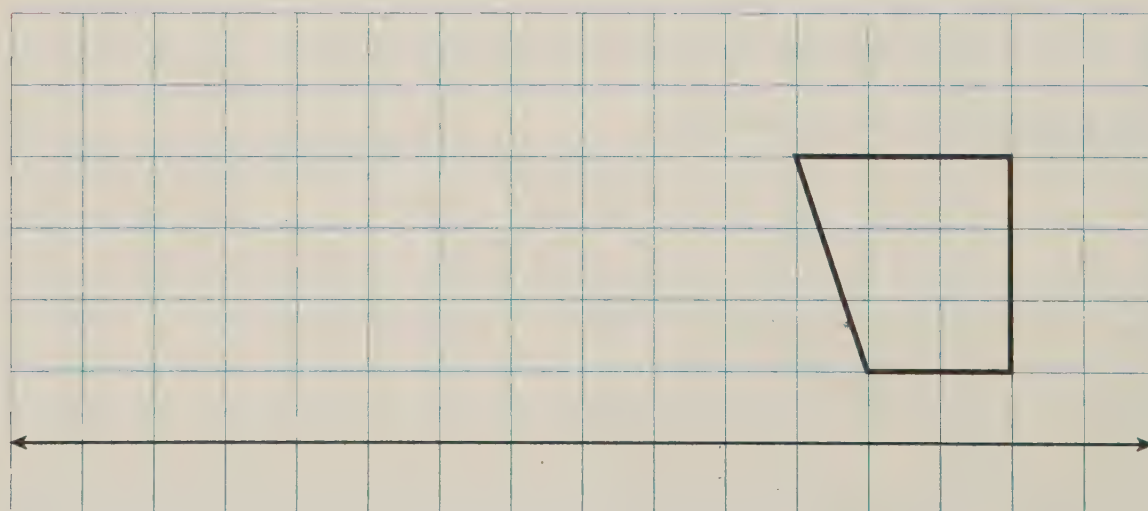
11 Draw a translation along the line.



12 Draw a translation along the line.



13 Draw a translation along the line.

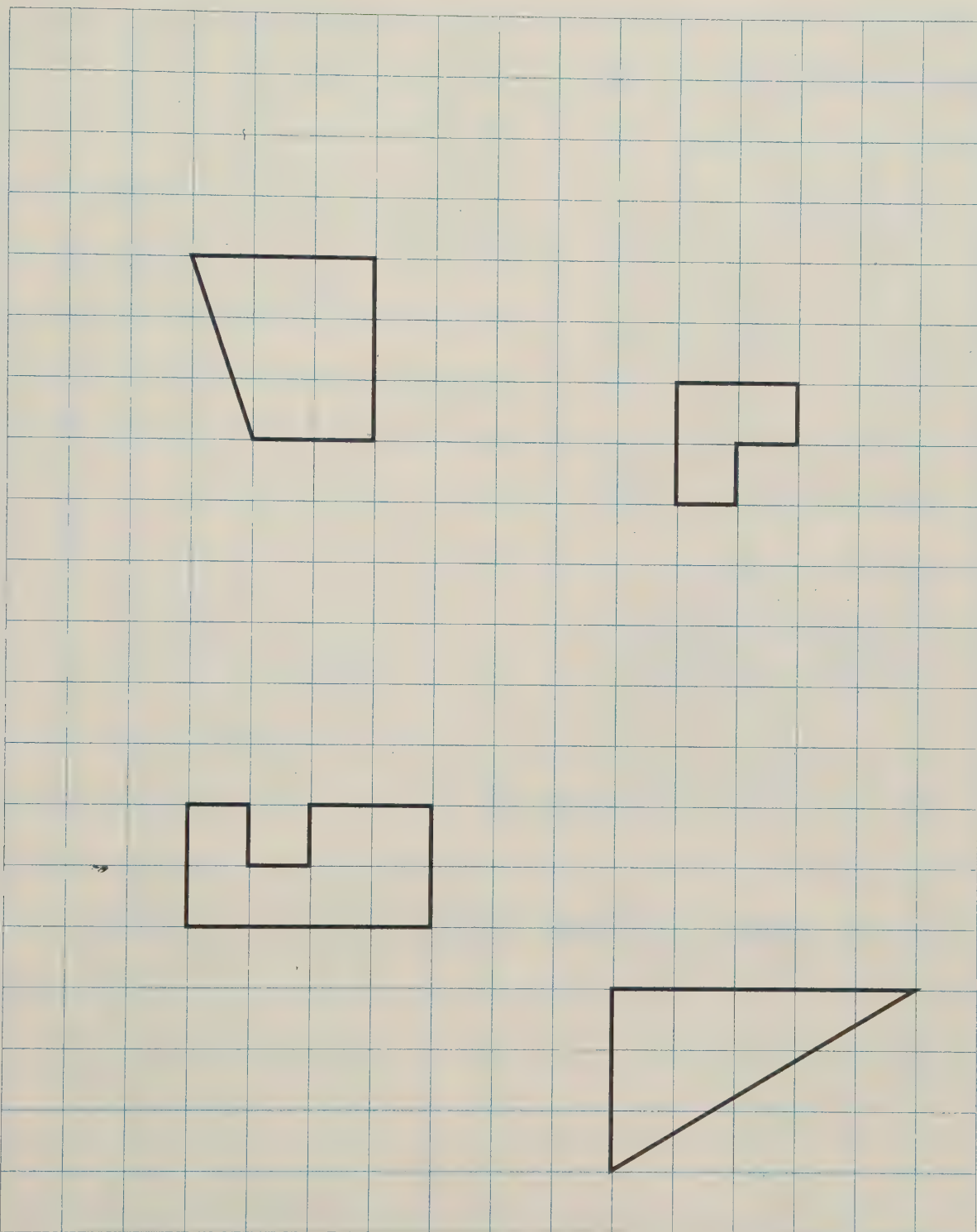


✓ Check Understanding

Explain how a reflection and a line of symmetry are related.

Cutouts

Cut out each figure.

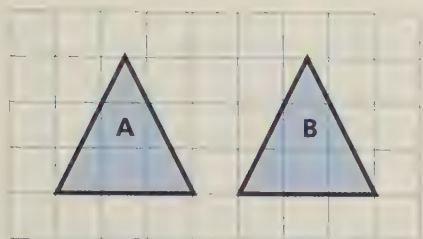




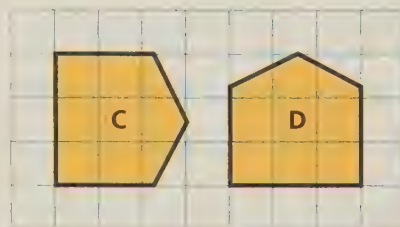
Identify Congruent Figures

Congruent figures are the same size and shape.

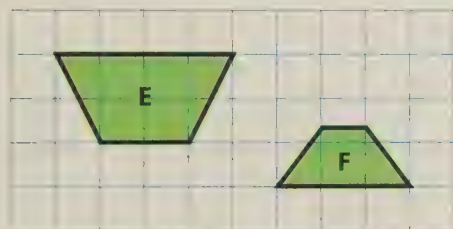
Figures A and B are congruent. They are the same size and shape.



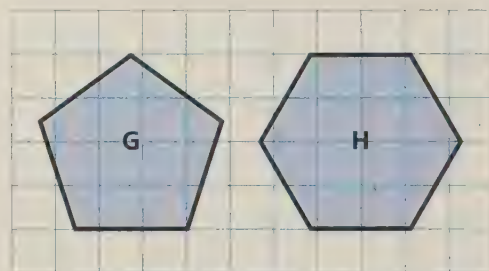
Figures C and D are congruent. One figure is turned, but they are the same size and shape.



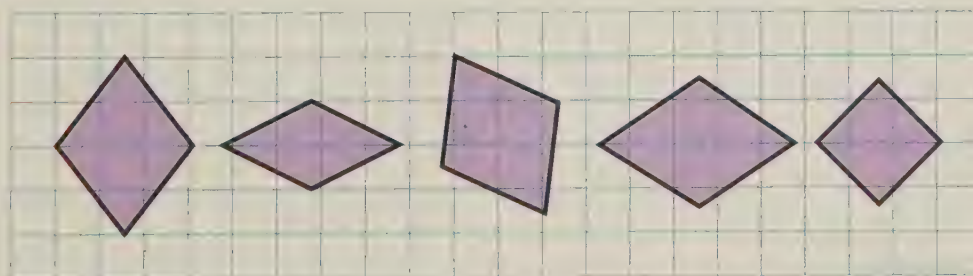
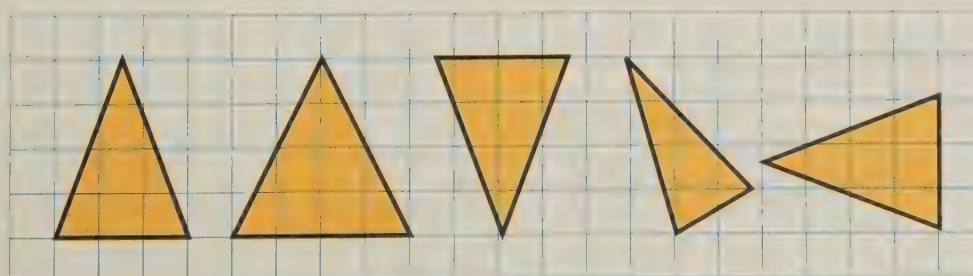
Figures E and F are not congruent. They are not the same size.



Figures G and H are not congruent. They are not the same shape.



In each row, loop all of the figures that look congruent.

1

2


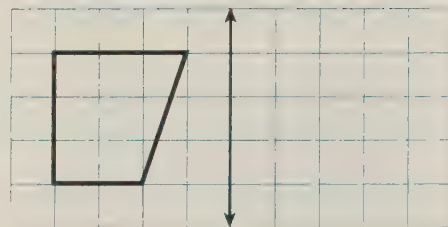
Transformations and Congruence

VOCABULARY
transformation

You have explored three **transformations**, or changes in the position of a figure.

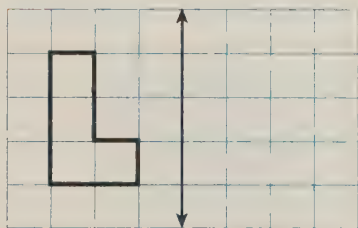
Will a rotation, reflection, or translation of a figure always produce a figure that is congruent to the original figure?

- 3 Will the reflection of the figure across the line produce a congruent figure? _____
Make a drawing to prove your answer.

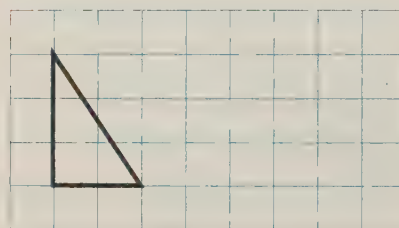


Draw a congruent figure using the transformation given.

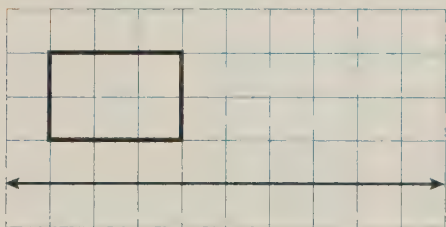
- 4 reflection



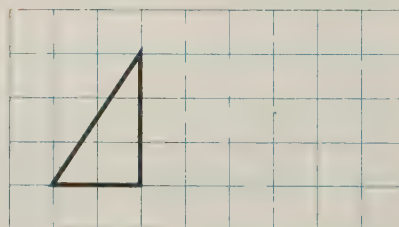
- 5 90° clockwise rotation



- 6 translation



- 7 90° counterclockwise rotation



✓ Check Understanding

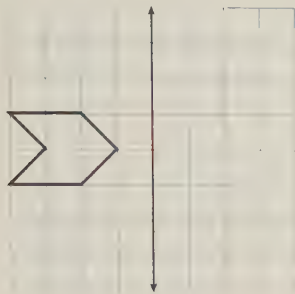
Complete.

If you turn, flip, or slide a figure, the new figure will be _____ to the original figure.

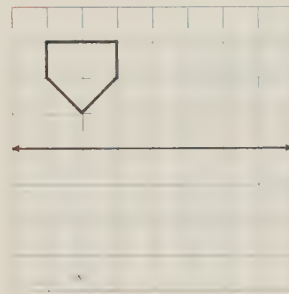
The original figure and the new figure will be the same _____ and _____.

Look at the figures.

- 1 Draw a reflection over the line.



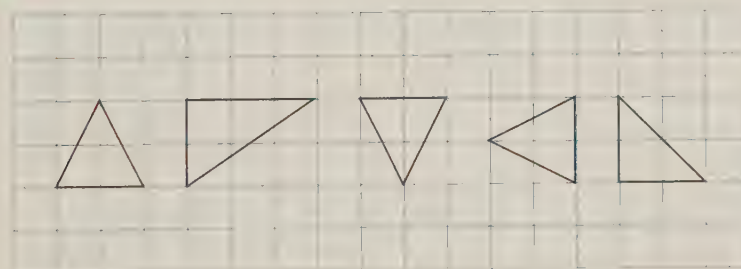
- 2 Draw a translation along the line.



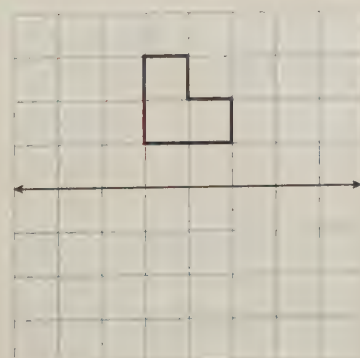
- 3 Draw a 90° clockwise rotation.



- 4 Circle the figures that look congruent.



- 5 Draw a congruent figure using reflection.



Multiply or divide.

$1 \quad 7 \times 0 = \square$

$2 \quad 12 \div 2 = \square$

$3 \quad 8 \times 3 = \square$

$4 \quad 16 \div 4 = \square$

$5 \quad 3 \times 7 = \square$

$6 \quad 42 \div 6 = \square$

$7 \quad 6 \times 8 = \square$

$8 \quad 81 \div 9 = \square$

$9 \quad 8 \times 7 = \square$

$10 \quad 4 \times 1 = \square$

$11 \quad 2 \div 1 = \square$

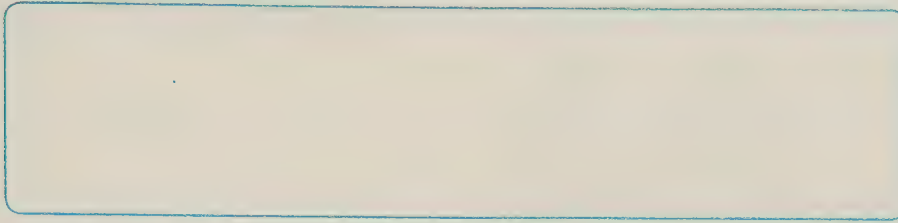
$12 \quad 3 \times 2 = \square$

$13 \quad 9 \div 3 = \square$

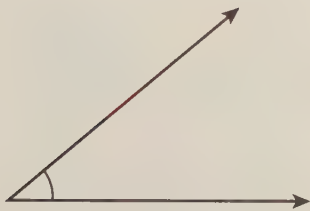
$14 \quad 5 \times 6 = \square$

$15 \quad 24 \div 4 = \square$

- 1 Draw and label line segment FG .



- 2 Use a protractor to measure the angle.

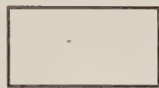


The angle measures _____.

- 3 Choose the figure that has at least one pair of parallel lines. Mark all that apply.



(A)



(B)

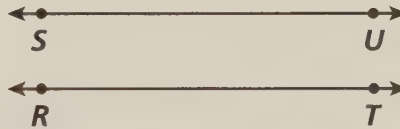
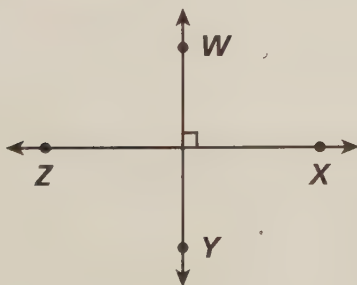


(C)



(D)

- 4 Use the figures. For 4a–4d, select True or False for the statement.



4a. $\overleftrightarrow{SU}$ and $\overleftrightarrow{RT}$ are intersecting lines.

☐ True

☐ False

4b. $\overleftrightarrow{SU}$ and $\overleftrightarrow{RT}$ are parallel.

☐ True

☐ False

4c. $\overleftrightarrow{ZX}$ and $\overleftrightarrow{WY}$ are perpendicular.

☐ True

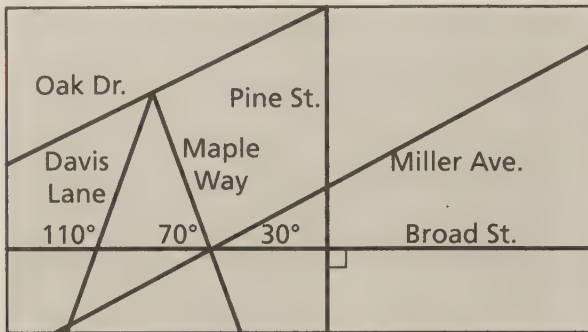
☐ False

4d. A line drawn through points R and U is perpendicular to $\overleftrightarrow{RT}$.

☐ True

☐ False

- 5 The map below shows a section of Fatima's town.



Part A Fatima is walking on Oak Drive and Gabe is walking on Miller Ave. Could Fatima and Gabe ever meet? If so, where?

Part B Which street is perpendicular to Broad St.? Explain how you know.

- 6 Choose the words that make a true statement.



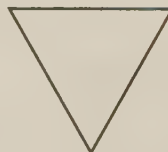
Angle BCD is _____ angle.

a right

an acute

an obtuse

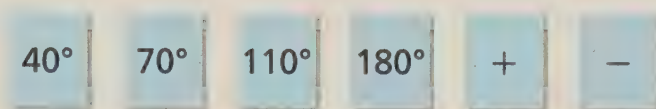
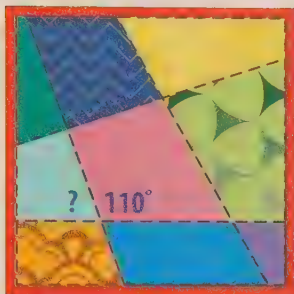
- 7 Draw all the lines of symmetry for the figure.



- 8 A gear in a watch turns clockwise, in one-degree sections, a total of 300 times.

The gear has turned a total of degrees.

- 9 Lucy is designing a block for a quilt. She measured one of the angles. Use the numbers and symbols on the tiles to write and solve an equation to find the unknown angle measure.



Equation: = ?

Solution: ? =

- 10 Luke is drawing a figure that has exactly 2 acute angles:
For 10a–10d, choose Yes or No to tell if the figure could be the figure Luke is drawing.

10a.  ☐ Yes ☐ No

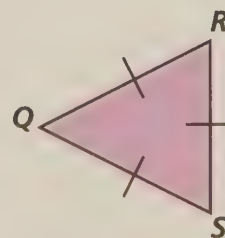
10b.  ☐ Yes ☐ No

10c.  ☐ Yes ☐ No

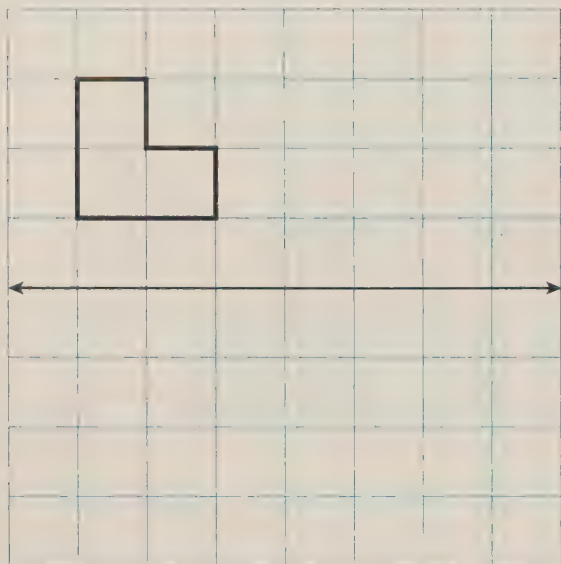
10d.  ☐ Yes ☐ No

- 11 Triangle QRS can be classified

as triangle.

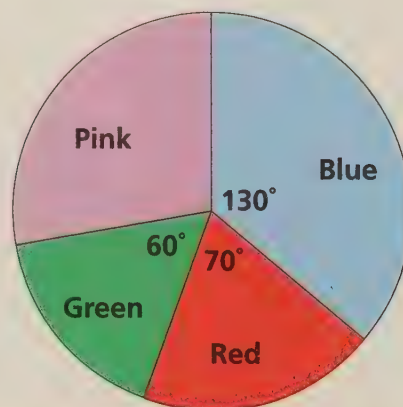


- 12 Draw a congruent figure using translation.



- 13 A sign has two pairs of parallel sides and two pairs of equal sides. Name one type of quadrilateral that the sign could be.

- 14 The circle represents all of the students in a class. Each section represents the students in the class who chose a certain color as their favorite. The angle measures for some sections are given.



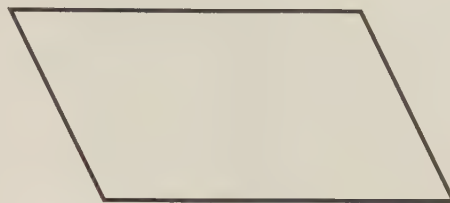
Part A

What is the sum of the angle measures for Blue, Red, and Green?

Part B

Explain how to find the angle measure for Pink. Then find the measure.

- 15 Draw one diagonal in the figure to form two obtuse triangles.



- 16 Does the figure have a line of symmetry? Explain.



- 17 A Ferris wheel turns 35° before it pauses. It turns another 85° before stopping again.

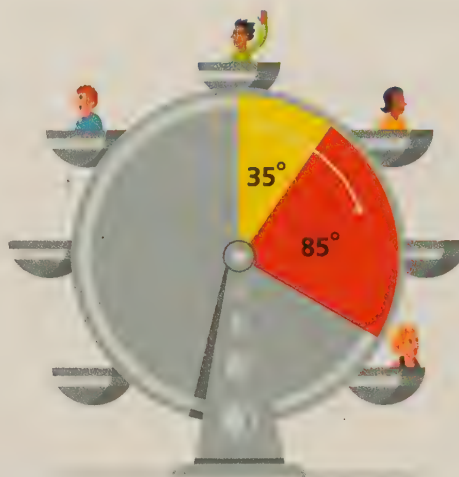
Part A

What is the total measure of the angle that the Ferris wheel turned?

Part B

How many more times will it need to repeat the pattern to turn 360° ?

Explain your thinking.



- 18 Cross Street, West Street, and Carmichael Street form a triangle.



How can the triangle be classified? Mark all that apply.

- ☐ scalene ☐ isosceles ☐ equilateral
☐ acute ☐ right ☐ obtuse

- 19 A stage has four sides with exactly one pair of parallel sides.

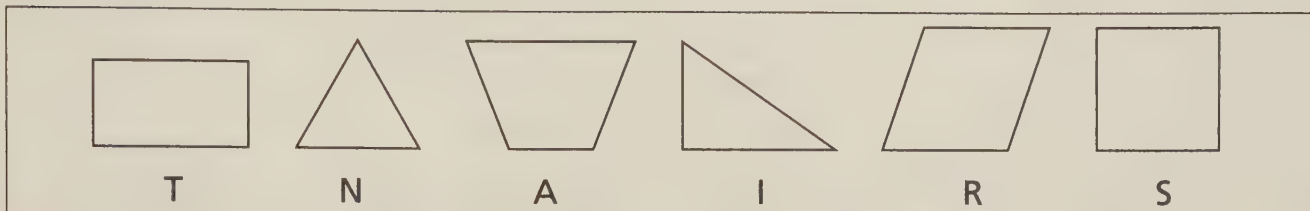
Marjorie says the shape of the stage is a quadrilateral and a rectangle. Do you agree? Explain.

- 20 What is the unknown angle measure in this pattern?



Crack a Secret Code

Meredith developed a secret code using the letters she labeled these polygons. Use what you know about polygons to solve each problem.



- 1 Make a word using the letters of all the polygons that are **not** quadrilaterals.

- 2 Make a word using the letters of all the polygons that have parallel sides.

- 3 Make a word using the letters of all the polygons that have perpendicular sides.

- 4 Make a word using the letters of all the polygons that have acute angles.

- 5 Meredith wants to use the letters of three polygons to write the word "ran." Write a description for the polygons that she can use.

- 6 Meredith thinks she can use all of the polygons to write "strain" using the description "All polygons that have at least two sides with equal side lengths." Is she correct? If not, which figure or figures do not match the description?

- 7 Meredith wants to write the word "are," but she needs a new figure to represent the letter E. Draw a polygon for E. Then describe the attributes of the polygons whose letters spell "are."

- 8 Can you write a description for attributes of polygons whose letters spell the word "ant?" Explain why or why not.

- 9 Explain how polygons *T* and *R* are alike and different.

- 10 Write your own description for the polygons whose letters spell a word of your choice. Make sure that the attributes you choose for your description are shared with all of the letters in your word and are not shared with any letters not in your word.

Examples of Metric Units

Length

1 kilometer (km)

about the distance
you could walk in
12 minutes

$$1 \text{ km} = 1,000 \text{ m}$$

**1 hectometer (hm)**

about the length of
a football field

$$1 \text{ hm} = 100 \text{ m}$$

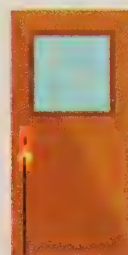
**1 dekameter (dam)**

about the length of
a school bus

$$1 \text{ dam} = 10 \text{ m}$$

**1 meter (m)**

about the distance
from the floor to
the doorknob

**1 decimeter (dm)**

about the length of a
new crayon

$$10 \text{ dm} = 1 \text{ m}$$

**1 centimeter (cm)**

about the width of
your finger

$$100 \text{ cm} = 1 \text{ m}$$

**1 millimeter (mm)**

about the thickness of
a dime

$$1,000 \text{ mm} = 1 \text{ m}$$



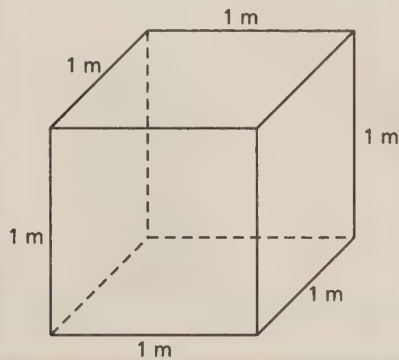
Examples of Metric Units

Liquid Volume

1 kiloliter (kL)

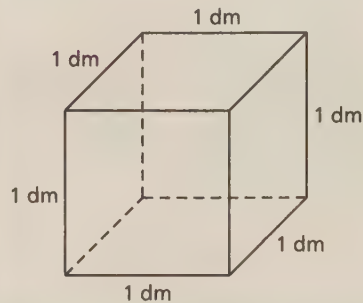
This cube holds 1 kiloliter of liquid.

$$1 \text{ kL} = 1,000 \text{ L}$$



1 liter (L)

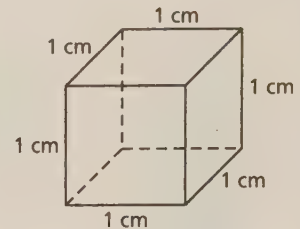
This cube holds 1 liter of liquid.



1 milliliter (mL)

This cube holds 1 milliliter of liquid.

$$1,000 \text{ mL} = 1 \text{ L}$$



Mass

1 kilogram (kg)

The mass of 5 bananas is about 1 kilogram.

$$1 \text{ kg} = 1,000 \text{ g}$$



1 gram (g)

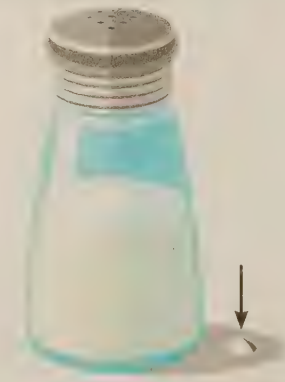
The mass of a paper clip is about 1 gram.



1 milligram (mg)

The mass of a pinch of salt is about 1 milligram.

$$1,000 \text{ mg} = 1 \text{ g}$$



Examples of Customary Units

Length

1 inch (in.)

The distance across a quarter is about 1 inch.



1 foot (ft)

The length of your math book is about 1 foot.

$$1 \text{ ft} = 12 \text{ in.}$$



1 yard (yd)

The length of a guitar is about 1 yard.

$$1 \text{ yd} = 3 \text{ ft}$$



1 mile (mi)

You can walk 1 mile in about 20 minutes.

$$1 \text{ mi} = 5,280 \text{ ft} \\ = 1,760 \text{ yd}$$



Liquid Volume

1 cup (c)

$$1 \text{ c} = 8 \text{ fluid ounces}$$



1 pint (pt)

$$1 \text{ pt} = 2 \text{ c}$$



1 quart (qt)

$$1 \text{ qt} = 2 \text{ pt} \\ = 4 \text{ c}$$



1 half gallon ($\frac{1}{2}$ gal)

$$\frac{1}{2} \text{ gal} = 2 \text{ qt}$$



1 gallon (gal)

$$1 \text{ gal} = 4 \text{ qt}$$



Examples of Customary Units

Weight

1 ounce (oz)

A slice of bread weighs about 1 ounce.



1 pound (lb)

A package of butter weighs 1 pound.

$1 \text{ lb} = 16 \text{ oz}$



1 ton (T)

A small car weighs about 1 ton.

$1 \text{ T} = 2,000 \text{ lb}$



Table of Measures

Metric	Customary
Length/Area	
1,000 millimeters (mm) = 1 meter (m)	1 foot (ft) = 12 inches (in.)
100 centimeters (cm) = 1 meter	1 yard (yd) = 36 inches
10 decimeters (dm) = 1 meter	1 yard = 3 feet
1 dekameter (dam) = 10 meters	1 mile (mi) = 5,280 feet
1 hectometer (hm) = 100 meters	1 mile = 1,760 yards
1 kilometer (km) = 1,000 meters	
Liquid Volume	
1,000 milliliters (mL) = 1 liter (L)	6 teaspoons (tsp) = 1 fluid ounce (fl oz)
100 centiliters (cL) = 1 liter	2 tablespoons (tbsp) = 1 fluid ounce
10 deciliters (dL) = 1 liter	1 cup (c) = 8 fluid ounces
1 dekaliter (daL) = 10 liters	1 pint (pt) = 2 cups
1 hectoliter (hL) = 100 liters	1 quart (qt) = 2 pints
1 kiloliter (kL) = 1,000 liters	1 gallon (gal) = 4 quarts
Mass	Weight
1,000 milligrams (mg) = 1 gram (g)	1 pound (lb) = 16 ounces
100 centigrams (cg) = 1 gram	1 ton (T) = 2,000 pounds
10 decigrams (dg) = 1 gram	
1 dekagram (dag) = 10 grams	
1 hectogram (hg) = 100 grams	
1 kilogram (kg) = 1,000 grams	
1 metric ton = 1,000 kilograms	

Table of Units of Time

Time

1 minute (min) = 60 seconds (sec)

1 hour (hr) = 60 minutes

1 day = 24 hours

1 week (wk) = 7 days

1 month is about 30 days

1 year (yr) = 12 months (mo)
or about 52 weeks

1 year = 365 days

1 leap year = 366 days

1 decade = 10 years

1 century = 100 years

1 millennium = 1,000 years

Table of Formulas

Perimeter

Polygon

P = sum of the lengths of the sides

Rectangle

$P = 2(l + w)$ or $P = 2l + 2w$

Square

$P = 4s$

Area

Rectangle

$A = lw$ or $A = bh$

Square

$A = s \cdot s$

Properties of Operations

Associative Property of Addition

$$(a + b) + c = a + (b + c)$$

$$(2 + 5) + 3 = 2 + (5 + 3)$$

Commutative Property of Addition

$$a + b = b + a$$

$$4 + 6 = 6 + 4$$

Addition Identity Property of 0

$$a + 0 = 0 + a = a$$

$$3 + 0 = 0 + 3 = 3$$

Associative Property of Multiplication

$$(a \cdot b) \cdot c = a \cdot (b \cdot c)$$

$$(3 \cdot 5) \cdot 7 = 3 \cdot (5 \cdot 7)$$

Commutative Property of Multiplication

$$a \cdot b = b \cdot a$$

$$6 \cdot 3 = 3 \cdot 6$$

Multiplicative Identity Property of 1

$$a \cdot 1 = 1 \cdot a = a$$

$$8 \cdot 1 = 1 \cdot 8 = 8$$

Distributive Property of Multiplication over Addition

$$a \cdot (b + c) = (a \cdot b) + (a \cdot c)$$

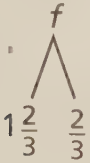
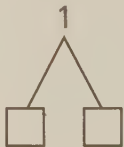
$$2 \cdot (4 + 3) = (2 \cdot 4) + (2 \cdot 3)$$

Addition and Subtraction Problem Types

	Result Unknown	Change Unknown	Start Unknown
Add to	A glass contained $\frac{3}{4}$ cup of orange juice. Then $\frac{1}{4}$ cup of pineapple juice was added. How much juice is in the glass now? <i>Situation and solution equation:</i>¹ $\frac{3}{4} + \frac{1}{4} = c$	A glass contained $\frac{3}{4}$ cup of orange juice. Then some pineapple juice was added. Now the glass contains 1 cup of juice. How much pineapple juice was added? <i>Situation equation:</i> $\frac{3}{4} + c = 1$ <i>Solution equation:</i> $c = 1 - \frac{3}{4}$	A glass contained some orange juice. Then $\frac{1}{4}$ cup of pineapple juice was added. Now the glass contains 1 cup of juice. How much orange juice was in the glass to start? <i>Situation equation:</i> $c + \frac{1}{4} = 1$ <i>Solution equation:</i> $c = 1 - \frac{1}{4}$
Take from	Micah had a ribbon $\frac{5}{6}$ yard long. He cut off a piece $\frac{1}{6}$ yard long. What is the length of the ribbon that is left? <i>Situation and solution equation:</i> $\frac{5}{6} - \frac{1}{6} = r$	Micah had a ribbon $\frac{5}{6}$ yard long. He cut off a piece. Now the ribbon is $\frac{4}{6}$ yard long. What is the length of the ribbon he cut off? <i>Situation equation:</i> $\frac{5}{6} - r = \frac{4}{6}$ <i>Solution equation:</i> $r = \frac{5}{6} - \frac{4}{6}$	Micah had a ribbon. He cut off a piece $\frac{1}{6}$ yard long. Now the ribbon is $\frac{4}{6}$ yard long. What was the length of the ribbon he started with? <i>Situation equation:</i> $r - \frac{1}{6} = \frac{4}{6}$ <i>Solution equation:</i> $r = \frac{4}{6} + \frac{1}{6}$

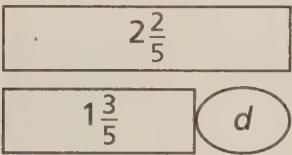
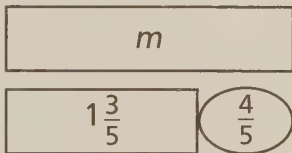
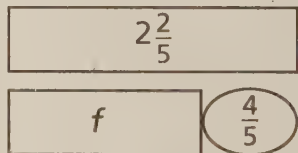
¹A situation equation represents the structure (action) in the problem situation. A solution equation shows the operation used to find the answer.

Addition and Subtraction Problem Types (continued)

	Total Unknown	Addend Unknown	Other Addend Unknown
Put Together/ Take Apart	A baker combines $1\frac{2}{3}$ cups of white flour and $\frac{2}{3}$ cup of wheat flour. How much flour is this altogether? <i>Math drawing:</i>¹  <i>Situation and solution equation:</i> $1\frac{2}{3} + \frac{2}{3} = f$	Of the $2\frac{1}{3}$ cups of flour a baker uses, $1\frac{2}{3}$ cups are white flour. The rest is wheat flour. How much wheat flour does the baker use? <i>Math drawing:</i>  <i>Situation equation:</i> $2\frac{1}{3} = 1\frac{2}{3} + f$ <i>Solution equation:</i> $f = 2\frac{1}{3} - 1\frac{2}{3}$	A baker uses $2\frac{1}{3}$ cups of flour. Some is white flour and $\frac{2}{3}$ cup is wheat flour. How much white flour does the baker use? <i>Math drawing:</i>  <i>Situation equation:</i> $2\frac{1}{3} = f + \frac{2}{3}$ <i>Solution equation:</i> $f = 2\frac{1}{3} - \frac{2}{3}$
	Both Addends Unknown is a productive extension of this basic situation, especially for finding two fractions with a sum of 1. Such take apart situations can be used to show all the decompositions of a given number. The associated equations, which have the total on the left of the equal sign, help students understand that the = sign does not always mean <i>makes</i> or <i>results in</i> but always does mean <i>is the same number as</i>.		Both Addends Unknown A baker is making different kinds of bread using only the $\frac{1}{4}$ cup measure. What different mixtures can be made with white flour and wheat flour to total 1 cup? <i>Math drawing:</i>  <i>Situation equation:</i> $1 = \square + \square$

¹These math drawings are called math mountains in Grades 1–3 and break apart drawings in Grades 4 and 5.

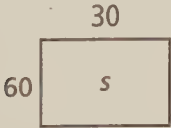
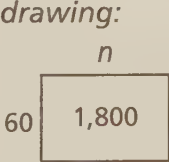
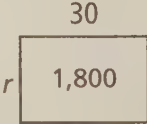
Addition and Subtraction Problem Types (continued)

	Difference Unknown	Greater Unknown	Smaller Unknown
Additive Comparison ¹	At a zoo, the female rhino weighs $1\frac{3}{5}$ tons. The male rhino weighs $2\frac{2}{5}$ tons. How much more does the male rhino weigh than the female rhino? At a zoo, the female rhino weighs $1\frac{3}{5}$ tons. The male rhino weighs $2\frac{2}{5}$ tons. How much less does the female rhino weigh than the male rhino? <i>Math drawing:</i>  <i>Situation equation:</i> $1\frac{3}{5} + d = 2\frac{2}{5}$ or $d = 2\frac{2}{5} - 1\frac{3}{5}$ <i>Solution equation:</i> $d = 2\frac{2}{5} - 1\frac{3}{5}$	Leading Language At a zoo, the female rhino weighs $1\frac{3}{5}$ tons. The male rhino weighs $\frac{4}{5}$ ton more than the female rhino. How much does the male rhino weigh? Misleading Language At a zoo, the female rhino weighs $1\frac{3}{5}$ tons. The female rhino weighs $\frac{4}{5}$ ton less than the male rhino. How much does the male rhino weigh? <i>Math drawing:</i>  <i>Situation and solution equation:</i> $1\frac{3}{5} + \frac{4}{5} = m$	Leading Language At a zoo, the male rhino weighs $2\frac{2}{5}$ tons. The female rhino weighs $\frac{4}{5}$ ton less than the male rhino. How much does the female rhino weigh? Misleading Language At a zoo, the male rhino weighs $2\frac{2}{5}$ tons. The male rhino weighs $\frac{4}{5}$ ton more than the female rhino. How much does the female rhino weigh? <i>Math drawing:</i>  <i>Situation equation:</i> $f + \frac{4}{5} = 2\frac{2}{5}$ or $f = 2\frac{2}{5} - \frac{4}{5}$ <i>Solution equation:</i> $f = 2\frac{2}{5} - \frac{4}{5}$

¹A comparison sentence can always be said in two ways. One way uses *more*, and the other uses *fewer* or *less*. Misleading language suggests the wrong operation. For example, it says *the female rhino weighs $\frac{4}{5}$ ton less than the male*, but you have to add $\frac{4}{5}$ **ton** to the female's weight to get the male's weight.

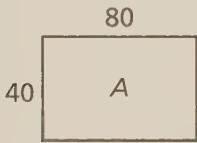
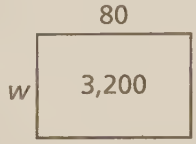
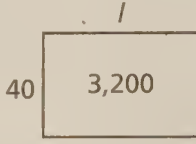
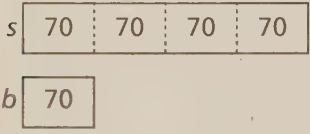
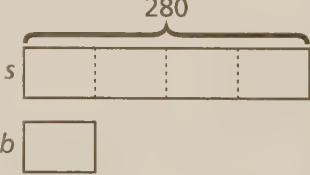
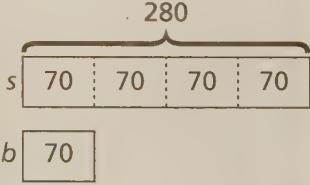
Multiplication and Division Problem Types

	Product Unknown	Group Size Unknown	Number of Groups Unknown
Equal Groups	A teacher bought 10 boxes of pencils. There are 20 pencils in each box. How many pencils did the teacher buy? <i>Situation and solution equation:</i> $p = 10 \cdot 20$	A teacher bought 10 boxes of pencils. She bought 200 pencils in all. How many pencils are in each box? <i>Situation equation:</i> $10 \cdot n = 200$ <i>Solution equation:</i> $n = 200 \div 10$	A teacher bought boxes of 20 pencils. She bought 200 pencils in all. How many boxes of pencils did she buy? <i>Situation equation:</i> $b \cdot 20 = 200$ <i>Solution equation:</i> $b = 200 \div 20$

	Product Unknown	Factor Unknown	Factor Unknown
Arrays¹	An auditorium has 60 rows with 30 seats in each row. How many seats are in the auditorium? <i>Math drawing:</i>  <i>Situation and solution equation:</i> $s = 60 \cdot 30$	An auditorium has 60 rows with the same number of seats in each row. There are 1,800 seats in all. How many seats are in each row? <i>Math drawing:</i>  <i>Situation equation:</i> $60 \cdot n = 1,800$ <i>Solution equation:</i> $n = 1,800 \div 60$	The 1,800 seats in an auditorium are arranged in rows of 30. How many rows of seats are there? <i>Math drawing:</i>  <i>Situation equation:</i> $r \cdot 30 = 1,800$ <i>Solution equation:</i> $r = 1,800 \div 30$

¹We use rectangle models for both array and area problems in Grades 4 and 5 because the numbers in the problems are too large to represent with arrays.

Multiplication and Division Problem Types (continued)

	Product Unknown	Factor Unknown	Factor Unknown
Area	Sophie's backyard is 80 feet long and 40 feet wide. What is the area of Sophie's backyard? <i>Math drawing:</i>  <i>Situation and solution equation:</i> $A = 80 \cdot 40$	Sophie's backyard has an area of 3,200 square feet. The length of the yard is 80 feet. What is the width of the yard? <i>Math drawing:</i>  <i>Situation equation:</i> $80 \cdot w = 3,200$ <i>Solution equation:</i> $w = 3,200 \div 80$	Sophie's backyard has an area of 3,200 square feet. The width of the yard is 40 feet. What is the length of the yard? <i>Math drawing:</i>  <i>Situation equation:</i> $l \cdot 40 = 3,200$ <i>Solution equation:</i> $l = 3,200 \div 40$
Multiplicative Comparison	Multiplier 1: Larger Unknown Sam has 4 times as many marbles as Brady has. Brady has 70 marbles. How many marbles does Sam have? <i>Math drawing:</i>  $b = s \div 4$ and $s = 4 \cdot b$ <i>Situation and solution equation:</i> $s = 4 \cdot 70$	Multiplier 1: Smaller Unknown Sam has 4 times as many marbles as Brady has. Sam has 280 marbles. How many marbles does Brady have? <i>Math drawing:</i>  $b = s \div 4$ and $s = 4 \cdot b$ <i>Situation equation:</i> $4 \cdot b = 280$ <i>Situation and solution equation:</i> $b = 280 \div 4$	Multiplier 1: Unknown Sam has 280 marbles. Brady has 70 marbles. The number of marbles Sam has is how many times the number Brady has? <i>Math drawing:</i>  $m \cdot b = s$ <i>Situation equation:</i> $m \cdot 70 = 280$ <i>Solution equation:</i> $m = 280 \div 70$

MathWord Power

Word Review



Work with a partner. Choose a word from the current unit or a review word from a previous unit. Use the word to complete one of the activities listed on the right. Then ask your partner if they have any edits to your work or questions about what you described. Repeat, having your partner choose a word.

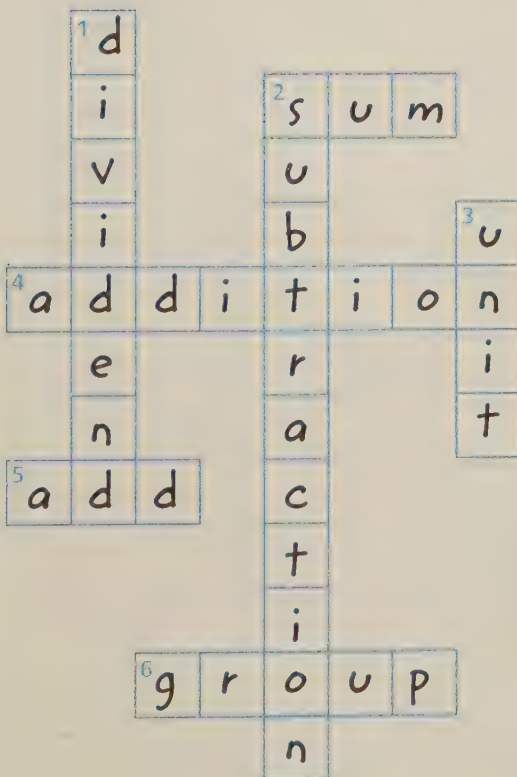
Activities

- Give the meaning in words or gestures.
- Use the word in a sentence.
- Give another word that is related to the word in some way and explain the relationship.

Crossword Puzzle



Create a crossword puzzle similar to the example below. Use vocabulary words from the unit. You can add other related words, too. Challenge your partner to solve the puzzle.



Across

- The answer to an addition problem
- _____ and subtraction are inverse operations.
- To put amounts together
- When you trade 10 ones for 1 ten, you _____.

Down

- The number to be divided in a division problem
- The operation that you can use to find out how much more one number is than another.
- A fraction with a numerator of 1 is a _____ fraction.

Vocabulary Activities

Word Wall



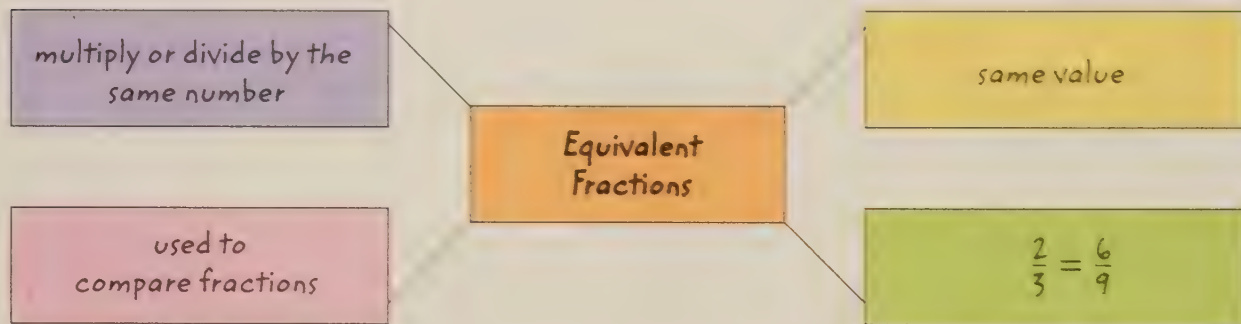
With your teacher's permission, start a word wall in your classroom. As you work through each lesson, put the math vocabulary words on index cards and place them on the word wall. You can work with a partner or a small group choosing a word and giving the definition.



Word Web



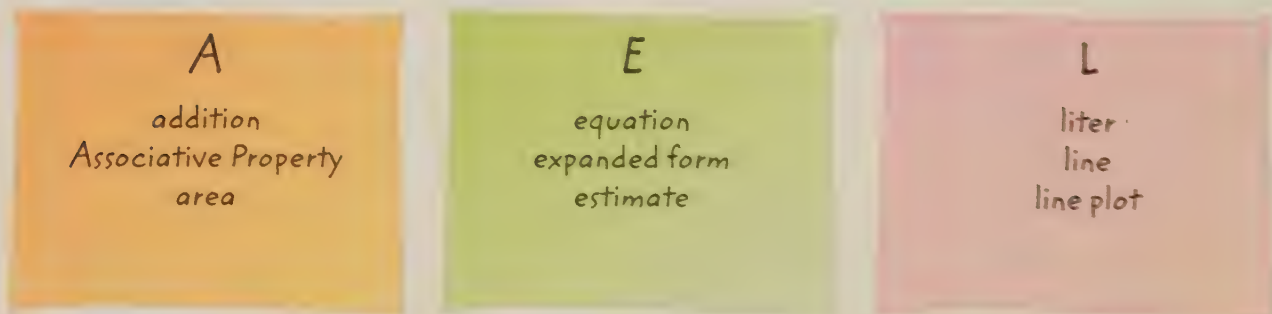
Make a word web for a word or words you do not understand in a unit. Fill in the web with words or phrases that are related to the vocabulary word.



Alphabet Challenge



Take an alphabet challenge. Choose 3 letters from the alphabet. Think of three vocabulary words for each letter. Then write the definition or draw an example for each word.



Concentration

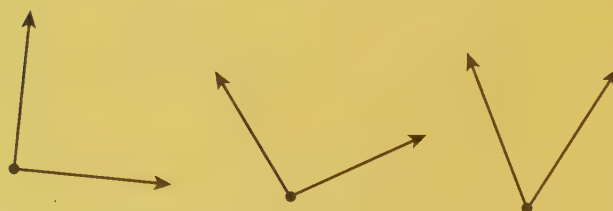
Write the vocabulary words and related words from a unit on index cards. Write the definitions on a different set of index cards. Choose 3 to 6 pairs of vocabulary words and definitions. Mix up the set of pairs. Then place the cards facedown on a table. Take turns turning over two cards. If one card is a word and one card is a definition that matches the word, take the pair. Continue until each word has been matched with its definition.



Math Journal

As you learn new words, write them in your Math Journal. Write the definition of the word and include a sketch or an example. As you learn new information about the word, add notes to your definition.

Angle: A figure formed by two rays with the same endpoint.



Degree: A unit for measuring angles.

Vocabulary Activities

What's the Word?



Work together to make a poster or bulletin board display of the words in a unit. Write definitions on a set of index cards. Mix up the cards. Work with a partner, choosing a definition from the index cards. Have your partner point to the word on the poster and name the matching math vocabulary word. Switch roles and try the activity again.



one of two or more numbers
added together to find a sum

array

place value

addend

inverse operations

expanded form

word form

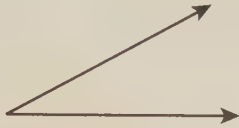
standard form

digit

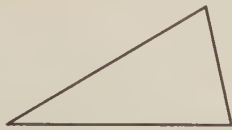
A

acute angle

An angle smaller than a right angle.

**acute triangle**

A triangle with three acute angles.

**addend**

One of two or more numbers added together to find a sum.

Example:

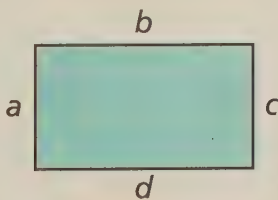
$$\begin{array}{c} 7 + 8 = 15 \\ \swarrow \quad \searrow \quad \swarrow \\ \text{addend} \quad \text{addend} \quad \text{sum} \end{array}$$

adjacent sides

Two sides that meet at a point.

Example:

Sides a and b are adjacent.

**Algebraic Notation Method***

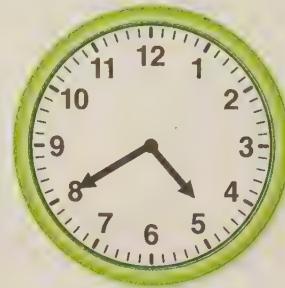
A strategy based on the Distributive Property in which a factor is decomposed to create simpler algebraic expressions, and the Distributive Property is applied.

Example:

$$\begin{aligned} 9 \cdot 28 &= 9 \cdot (20 + 8) \\ &= (9 \cdot 20) + (9 \cdot 8) \\ &= 180 + 72 \\ &= 252 \end{aligned}$$

analog clock

A clock with a face and hands.

**angle**

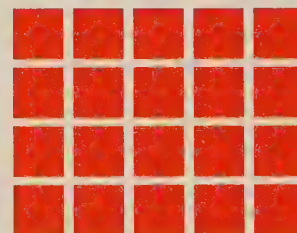
A figure formed by two rays with the same endpoint.

**area**

The number of square units that cover a figure.

**array**

An arrangement of objects, symbols, or numbers in rows and columns.

**Associative Property of Addition**

Grouping the addends in different ways does not change the sum.

Example:

$$\begin{aligned} 3 + (5 + 7) &= 15 \\ (3 + 5) + 7 &= 15 \end{aligned}$$

Associative Property of Multiplication

Grouping the factors in different ways does not change the product.

Example:

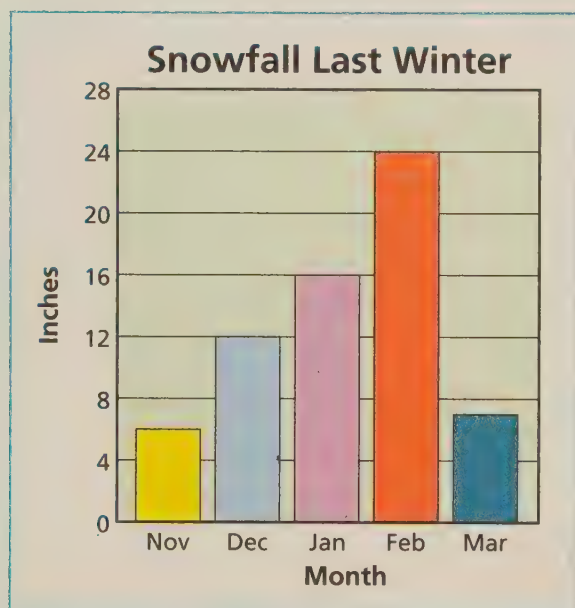
$$3 \times (5 \times 7) = 105$$

$$(3 \times 5) \times 7 = 105$$

B

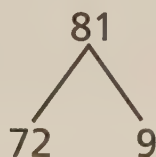
bar graph

A graph that uses bars to show data. The bars may be vertical or horizontal.



break-apart drawing*

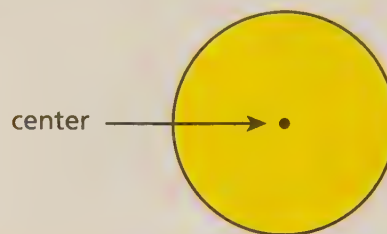
A diagram that shows two addends and the sum.



C

center

The point that is the same distance from every point on the circle.



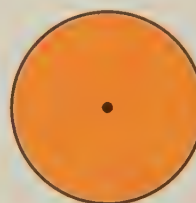
centimeter (cm)

A unit of measure in the metric system that equals one hundredth of a meter.

$$100 \text{ cm} = 1 \text{ m}$$

circle

A plane figure that forms a closed path so that all the points on the path are the same distance from a point called the center.



circle graph

A graph that uses parts of a circle to show data.

Favorite Fiction Books



column

A part of a table or array that contains items arranged vertically.

**common denominator**

A common multiple of two or more denominators.

Example:

A common denominator of $\frac{1}{2}$ and $\frac{1}{3}$ is 6 because 6 is a multiple of 2 and 3.

Commutative Property of Addition

Changing the order of addends does not change the sum.

Example: $3 + 8 = 11$
 $8 + 3 = 11$

Commutative Property of Multiplication

Changing the order of factors does not change the product.

Example: $3 \times 8 = 24$
 $8 \times 3 = 24$

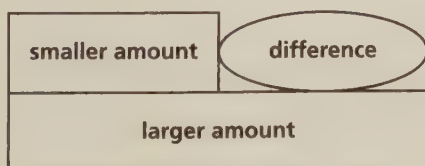
compare

Describe quantities as greater than, less than, or equal to each other.

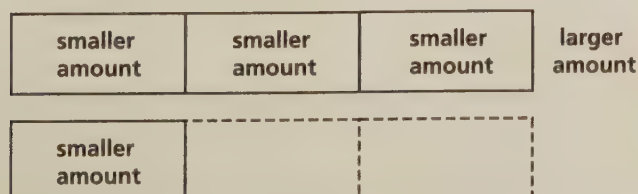
comparison bars*

Bars that represent the larger amount and smaller amount in a comparison situation.

For addition and subtraction:



For multiplication and division:

**comparison situation***

A situation in which two amounts are compared by addition or by multiplication. An *addition comparison situation* compares by asking or telling how much more (how much less) one amount is than another. A *multiplication comparison situation* compares by asking or telling how many times as many one amount is as another. The multiplication comparison may also be made using fraction language. For example, you can say, "Sally has one fourth as much as Tom has," instead of saying "Tom has 4 times as much as Sally has."

compatible numbers

Numbers that are easy to compute with mentally.

Example:

$9 \overline{)5,841}$ Some compatible numbers for the divisor and dividend are 9 and 5,400, and 9 and 6,300.

composite number

A number greater than 1 that has more than one factor pair. Examples of composite numbers are 10 and 18. The factor pairs of 10 are 1 and 10, 2 and 5. The factor pairs of 18 are 1 and 18, 2 and 9, 3 and 6.

congruent

Figures that are the same size and shape.

cup (c)

A unit of liquid volume in the U.S. customary system that equals 8 fluid ounces.

D**data**

A collection of information.

*A classroom research-based term developed for *Math Expressions*

Glossary

decimal number

A representation of a number using the numerals 0 to 9, in which each digit has a value 10 times the digit to its right. A dot or **decimal point** separates the whole-number part of the number on the left from the fractional part on the right.

Examples:

1.23 and 0.3

decimal point

A symbol used to separate dollars and cents in money amounts or to separate ones and tenths in decimal numbers.

Examples:

\$8.59 1.2
↑ ↑
decimal point

decimeter (dm)

A unit of measure in the metric system that equals one tenth of a meter.

10 dm = 1 m

degree (°)

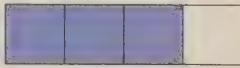
A unit for measuring angles.

denominator

The number below the bar in a fraction. It shows the total number of equal parts in the whole.

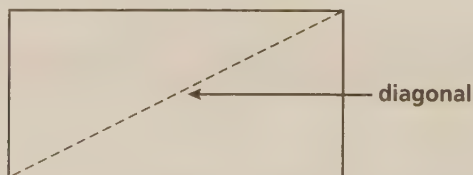
Example:

$\frac{3}{4}$ ← denominator



diagonal of a quadrilateral

A line segment that connects two opposite corners (vertices).



difference

The result of a subtraction.

Example:

$54 - 37 = 17$ ← difference

digit

Any of the symbols 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9.

digital clock

A clock that shows the hour and minutes with numbers.



Digit-by-Digit Method*

A method used to solve a division problem.

Put in only one digit at a time.

$$\begin{array}{r} 5 \swarrow \\ 7 \overline{) 3,822} \\ \underline{- 35} \\ 32 \end{array} \qquad \begin{array}{r} 54 \\ 7 \overline{) 3,822} \\ \underline{- 35} \\ 32 \\ \underline{- 28} \\ 42 \end{array} \qquad \begin{array}{r} 546 \\ 7 \overline{) 3,822} \\ \underline{- 35} \\ 32 \\ \underline{- 28} \\ 42 \\ \underline{- 42} \end{array}$$

Distributive Property

Multiplying a sum by a number, or multiplying each addend by the number and adding the products; the result is the same.

Example:

$$\begin{array}{rclcl} 3 \times (2 + 4) & = & (3 \times 2) + (3 \times 4) \\ 3 \times 6 & = & 6 + 12 \\ 18 & = & 18 \end{array}$$

dividend

The number that is divided in division.

Example:

$$\begin{array}{r} 7 \\ 9 \overline{) 63} \end{array}$$

63 is the dividend.

divisible

A number is divisible by another number if the quotient is a whole number with a remainder of 0.

divisor

The number you divide by in division.

Example:

$$\begin{array}{r} 7 \\ 9 \overline{)63} \end{array}$$

9 is the divisor.

dot array

An arrangement of dots in rows and columns.



E

elapsed time

The time that passes between the beginning and the end of an activity.

endpoint

The point at either end of a line segment or the beginning point of a ray.



equation

A statement that two expressions are equal. It has an equal sign.

Examples:

$$32 + 35 = 67$$

$$67 = 32 + 34 + 1$$

$$(7 \times 8) + 1 = 57$$

equilateral triangle

A triangle with three sides of equal length.



equivalent fractions

Two or more fractions that represent the same number.

Example:

$\frac{2}{4}$ and $\frac{4}{8}$ are equivalent because they both represent one half.

estimate

A number close to an exact amount or to find about how many or how much.

evaluate an expression

Substitute a value for a letter (or symbol) and then simplify the expression.

expanded form

A way of writing a number that shows the value of each of its digits.

Example:

Expanded form of 835:

$$800 + 30 + 5$$

8 hundreds + 3 tens + 5 ones

Expanded Notation Method*

A method used to solve multiplication and division problems.

Examples:

$$43 \times 67$$

$$\begin{array}{r} 67 = 60 + 7 \\ \times 43 = 40 + 3 \\ \hline 40 \times 60 = 2400 \\ 40 \times 7 = 280 \\ 3 \times 60 = 180 \\ 3 \times 7 = + 21 \\ \hline 2,881 \end{array}$$

$$3,822 \div 7$$

$$\begin{array}{r} 6 \\ 40 \\ 500 \\ 7 \overline{)3,822} \\ \underline{-3,500} \\ 322 \\ \underline{-280} \\ 42 \\ \underline{-42} \\ 0 \end{array} \quad \begin{array}{l} 6 \\ 40 \\ 500 \end{array} 546$$

Glossary

expression

A number, variable, or a combination of numbers and variables with one or more operations.

Examples:

4
 $6x$
 $6x - 5$
 $7 + 4$

F

factor

One of two or more numbers multiplied to find a product.

Example:

$$\begin{array}{ccccc} & 4 & \times & 5 & = & 20 \\ & \nearrow & & \nearrow & & \nearrow \\ \text{factor} & & & \text{factor} & & \text{product} \end{array}$$

factor pair

A factor pair for a number is a pair of whole numbers whose product is that number.

Example:

$$\begin{array}{ccccc} & 5 & \times & 7 & = & 35 \\ & \swarrow & & \nearrow & & \nearrow \\ \text{factor} & & & \text{factor} & & \text{product} \\ \text{pair} & & & & & \end{array}$$

fluid ounce (fl oz)

A unit of liquid volume in the U.S. customary system.

8 fluid ounces = 1 cup

foot (ft)

A U.S. customary unit of length equal to 12 inches.

formula

An equation with letters or symbols that describes a rule.

The formula for the area of a rectangle is:

$$A = l \times w$$

where A is the area, l is the length, and w is the width.

fraction

A number that is the sum of unit fractions, each an equal part of a set or part of a whole.

Examples:

$$\frac{3}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$$

$$\frac{5}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$$

function

A mathematical relationship between two sets of numbers. Each number in one of the sets is paired with exactly one number in the other set. A function may be displayed in a table.

Example:

The rule for this function is *Add 2*.

Input	1	4	5	8	12
Output	3	6	7	10	14

G

gallon (gal)

A unit of liquid volume in the U.S. customary system that equals 4 quarts.

gram (g)

The basic unit of mass in the metric system.

greater than ($>$)

A symbol used to compare two numbers. The greater number is given first below.

Example:

$$33 > 17$$

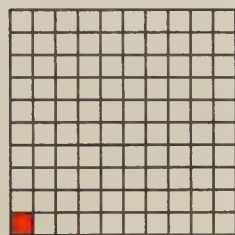
33 is greater than 17.

group

To combine numbers to form new tens, hundreds, thousands, and so on.

H**hundredth**

A unit fraction representing one of one hundred parts, written as 0.01 or $\frac{1}{100}$.



one hundredth = $\frac{1}{100} = 0.01$

7.634
↑
hundredth

I**Identity Property of Multiplication**

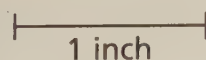
The product of 1 and any number equals that number.

Example:

$$10 \times 1 = 10$$

inch

A U.S. customary unit of length.

**inequality**

A statement that two expressions are not equal.

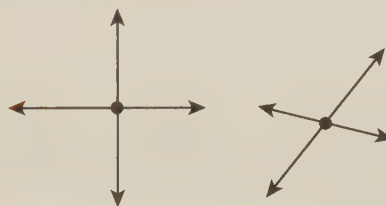
Examples:

$$2 < 5$$

$$4 + 5 > 12 - 8$$

intersecting lines

Lines that meet at a point.

**inverse operations**

Opposite or reverse operations that undo each other. Addition and subtraction are inverse operations. Multiplication and division are inverse operations.

Examples:

$$4 + 6 = 10 \text{ so, } 10 - 6 = 4 \text{ and } 10 - 4 = 6.$$

$$3 \times 9 = 27 \text{ so, } 27 \div 9 = 3 \text{ and } 27 \div 3 = 9.$$

isosceles triangle

A triangle with at least two sides of equal length.

**K****kilogram (kg)**

A unit of mass in the metric system that equals one thousand grams.

$$1 \text{ kg} = 1,000 \text{ g}$$

kiloliter (kL)

A unit of liquid volume in the metric system that equals one thousand liters.

$$1 \text{ kL} = 1,000 \text{ L}$$

Glossary

kilometer (km)

A unit of length in the metric system that equals 1,000 meters.

1 km = 1,000 m

kite

A quadrilateral with two pairs of equal adjacent sides.



L

least common denominator

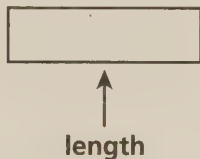
The least common multiple of two or more denominators.

Example:

The least common denominator of $\frac{1}{2}$ and $\frac{1}{3}$ is 6 because 6 is the smallest multiple of 2 and 3.

length

The measure of a line segment or the distance across the longer side of a rectangle.



less than (<)

A symbol used to compare two numbers.

The smaller number is given first below.

Example:

$54 < 78$

54 is less than 78.

line

A straight path that goes on forever in opposite directions.

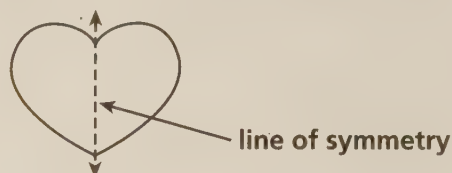
Example:

line AB



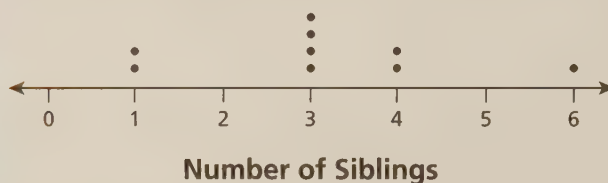
line of symmetry

A line on which a figure can be folded so that the two halves match exactly.



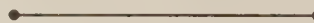
line plot

A diagram that shows the frequency of data on a number line. Also called a dot plot.



line segment

Part of a line that has two endpoints.



line symmetry

A figure has line symmetry if it can be folded along a line to create two halves that match exactly.



liquid volume

A measure of the space a liquid occupies.

liter (L)

The basic unit of liquid volume in the metric system.

1 liter = 1,000 milliliters

M

mass

The measure of the amount of matter in an object.

meter (m)

The basic unit of length in the metric system.

metric system

A base ten system of measurement.

mile (mi)

A U.S. customary unit of length equal to 5,280 feet.

milligram (mg)

A unit of mass in the metric system.
1,000 mg = 1 g

milliliter (mL)

A unit of liquid volume in the metric system.
1,000 mL = 1 L

millimeter (mm)

A unit of length in the metric system.
1,000 mm = 1 m

mixed number

A number that can be represented by a whole number and a fraction.

Example:

$$4\frac{1}{2} = 4 + \frac{1}{2}$$

multiple

A number that is the product of a given number and any whole number.

Examples:

$$4 \times 1 = 4, \text{ so } 4 \text{ is a multiple of } 4.$$

$$4 \times 2 = 8, \text{ so } 8 \text{ is a multiple of } 4.$$

N

number line

A line that extends, without end, in each direction and shows numbers as a series of points. The location of each number is shown by its distance from 0.

numerator

The number above the bar in a fraction. It shows the number of equal parts.

Example:

$$\frac{3}{4} \leftarrow \text{numerator} \quad \frac{3}{4} = \frac{1}{4} + \frac{1}{4} + \frac{1}{4}$$

O

obtuse angle

An angle greater than a right angle and less than a straight angle.

**obtuse triangle**

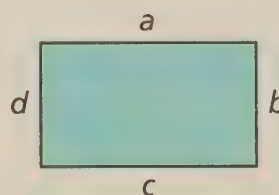
A triangle with one obtuse angle.

**opposite sides**

Sides that are across from each other; they do not meet at a point.

Example:

Sides *a* and *c* are opposite.



order

Arrange numbers from the least number to the greatest number or from the greatest number to the least number.

Examples:

Least to greatest: 453, 526, 571, 802

Greatest to least: 3,742; 3,608; 3,295

Order of Operations

A set of rules that state the order in which operations should be done.

STEP 1: Compute inside parentheses first.

STEP 2: Multiply and divide from left to right.

STEP 3: Add and subtract from left to right.

ounce (oz)

A U.S. customary unit of weight.

16 ounces = 1 pound

A U.S. customary unit of liquid volume (also called a fluid ounce).

8 ounces = 1 cup

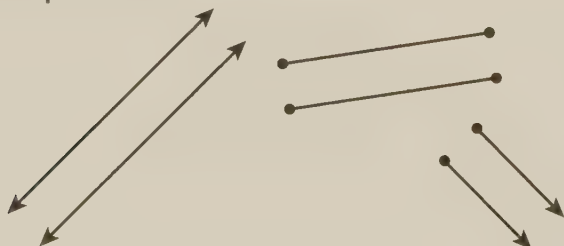
overestimate

Make an estimate that is too big.

P

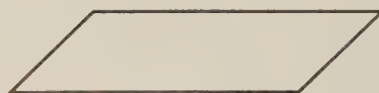
parallel lines

Lines in the same plane that never intersect are parallel. Line segments and rays that are part of parallel lines are also parallel.



parallelogram

A quadrilateral with both pairs of opposite sides parallel.



partial product

The product of the ones, or tens, or hundreds, and so on in multidigit multiplication.

Example:

$$\begin{array}{r} 24 \\ \times 9 \\ \hline 36 \\ 180 \\ \hline 216 \end{array}$$

← partial product (9×4)

← partial product (9×20)

pattern

A sequence that can be described by a rule.

perimeter

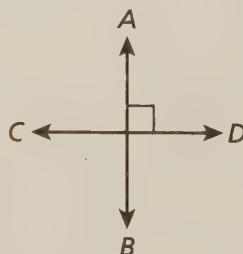
The distance around a figure.

perpendicular lines

Lines, line segments, or rays are perpendicular if they form right angles.

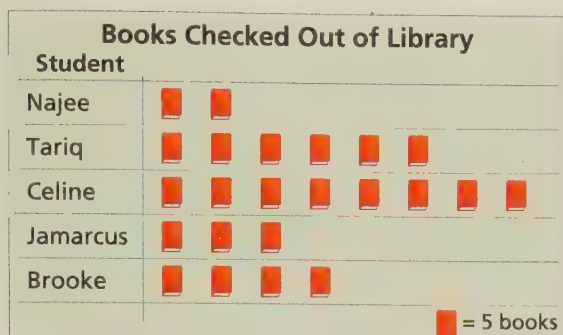
Example:

These two lines are perpendicular.



pictograph

A graph that uses pictures or symbols to represent data.



pint (pt)

A U.S. customary unit of liquid volume that equals 16 fluid ounces.

place value

The value assigned to the place that a digit occupies in a number.

Example:

235

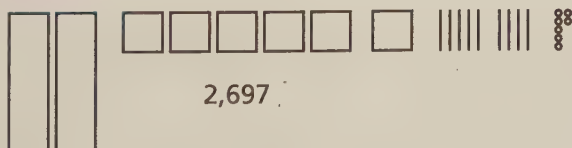


The 2 is in the hundreds place, so its value is 200.

place-value drawing*

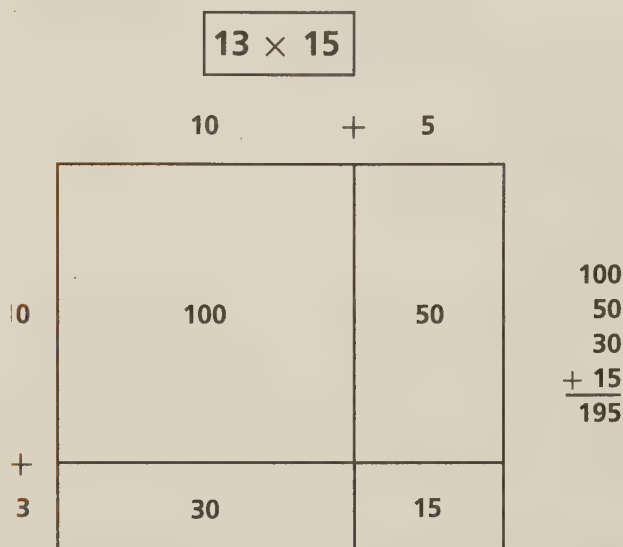
A drawing that represents a number. Thousands are represented by vertical rectangles, hundreds are represented by squares, tens are represented by vertical lines, and ones by small circles.

Example:



Place-Value Sections Method*

A method using rectangle drawings to solve multiplication or division problems.



$330 \div 5$

a.

5 $\overline{) 330}$

b.

60
5 $\overline{) 330}$
- 300
30

c.

60 +
5 $\overline{) 330}$
- 300
30

d.

60 +
5 $\overline{) 330}$ 30
- 300
30

e.

60 + 6
5 $\overline{) 330}$ 30
- 300 - 30
30

f.

60 + 6 = 66
5 $\overline{) 330}$ 30
- 300 - 30
30 0

point

A location in a plane. It is usually shown by a dot.

polygon

A closed plane figure with sides made of straight line segments.

pound (lb)

A unit of weight in the U.S. customary system.

prefix

A letter or group of letters placed before a word to make a new word.

Glossary

prime number

A number greater than 1 that has 1 and itself as the only factor pair. Examples of prime numbers are 2, 7, and 13. The only factor pair of 7 is 1 and 7.

product

The answer to a multiplication problem.

Example:

$$9 \times 7 = 63$$

↑
product

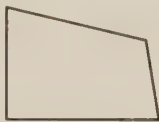
protractor

A semicircular tool for measuring and constructing angles.

Q

quadrilateral

A polygon with four sides.



quart (qt)

A U.S. customary unit of liquid volume that equals 32 fluid ounces or 4 cups.

quotient

The answer to a division problem.

Example:

$$\begin{array}{r} 7 \\ 9 \overline{)63} \end{array}$$

7 is the quotient.

R

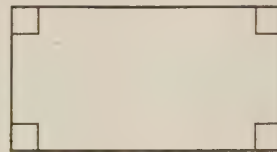
ray

Part of a line that has one endpoint and extends without end in one direction.



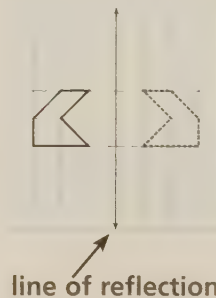
rectangle

A parallelogram with four right angles.



reflection

A flip of a figure across a line, which is called the line of reflection.



reflex angle

An angle with a measure that is greater than 180° and less than 360° .

remainder

The number left over after dividing two numbers that are not evenly divisible.

Example:

$$\begin{array}{r} 8 \text{ R}3 \\ 5 \overline{)43} \end{array}$$

The remainder is 3.

rhombus

A parallelogram with sides of equal length.



right angle

An angle that measures 90° .

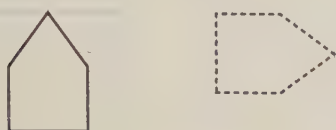
right triangle

A triangle with one right angle.



rotation

A turn of a figure in degrees ($^{\circ}$), either clockwise or counterclockwise. **Example:**



rounding

Finding the nearest ten, hundred, thousand, or some other place value. The usual rounding rule is to round up if the next digit to the right is 5 or more and round down if the next digit to the right is less than 5.

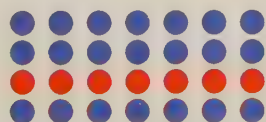
Examples:

463 rounded to the nearest ten is 460.

463 rounded to the nearest hundred is 500.

row

A part of a table or array that contains items arranged horizontally.



S

scalene triangle

A triangle with no equal sides.



Shortcut Method*

A strategy for multiplying. It is the current common method in the United States.

Step 1	Step 2
$\begin{array}{r} 7 \\ 28 \\ \times 9 \\ \hline 2 \end{array}$	$\begin{array}{r} 7 \\ 28 \\ \times 9 \\ \hline 252 \end{array}$

simplest form

A fraction is in simplest form if there is no whole number (other than 1) that divides evenly into the numerator and denominator.

Example:

$\frac{3}{4}$ This fraction is in simplest form because no number divides evenly into 3 and 4.

simplify an expression

Combining like terms and performing operations until all possible terms have been combined.

simplify a fraction

Dividing the numerator and the denominator of a fraction by the same number to make an equivalent fraction made from fewer but larger unit fractions.

Example:

$$\frac{5}{10} = \frac{5 \div 5}{10 \div 5} = \frac{1}{2}$$

situation equation*

An equation that shows the structure of the information in a problem.

Example:

$$35 + n = 40$$

solution equation*

An equation that shows the operation that can be used to solve the problem.

Example:

$$n = 40 - 35$$

*A classroom research-based term developed for *Math Expressions*

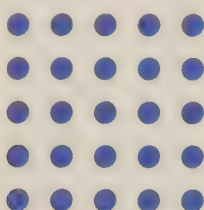
square

A rectangle with 4 sides of equal length and 4 right angles. It is also a rhombus.



square array

An array in which the number of rows equals the number of columns.



square centimeter (cm²)

A unit of area equal to the area of a square with one-centimeter sides.

square decimeter (dm²)

A unit of area equal to the area of a square with one-decimeter sides.

square foot (ft²)

A unit of area equal to the area of a square with one-foot sides.

square inch (in.²)

A unit of area equal to the area of a square with one-inch sides.

square kilometer (km²)

A unit of area equal to the area of a square with one-kilometer sides.

square meter (m²)

A unit of area equal to the area of a square with one-meter sides.

square mile (mi²)

A unit of area equal to the area of a square with one-mile sides.

square millimeter (mm²)

A unit of area equal to the area of a square with one-millimeter sides.

square number

The product of a whole number and itself.

Example:

$$3 \times 3 = 9$$



square number

square unit (unit²)

A unit of area equal to the area of a square with one-unit sides.

square yard (yd²)

A unit of area equal to the area of a square with one-yard sides.

standard form

The form of a number written using digits.

Example:

2,145

straight angle

An angle that measures 180°.

sum

The answer when adding two or more addends.

Example:

$$53 + 26 = 79$$

↑
↑
↑
 addend addend sum

T

table

Data arranged in rows and columns.

tenth

A unit fraction representing one of ten equal parts of a whole, written as 0.1 or $\frac{1}{10}$.



12.34
↑
tenth

term

A number, variable, product, or quotient in an expression or equation. Each term is separated by an operation sign (+, -).

Example:

$3n + 5$ has two terms, $3n$ and 5.

thousandth

A unit fraction representing one of one thousand equal parts of a whole, written as 0.001 or $\frac{1}{1,000}$.

ton

A U.S. customary unit of weight that equals 2,000 pounds.

tonne

A metric unit of mass that equals 1,000 kilograms.

total

Sum; the result of addition.

Example:

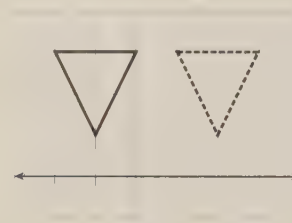
$$\begin{array}{ccccc} & 53 & + & 26 & = & 79 \\ & \uparrow & & \uparrow & & \uparrow \\ & \text{addend} & & \text{addend} & & \text{total (sum)} \end{array}$$

transformation

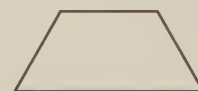
A change in the position of a figure. Rotations, reflections, and translations are types of transformations.

translation

A slide of a figure. Each point of the figure moves the same distance in the same direction.

Example:**trapezoid**

A quadrilateral with exactly one pair of parallel sides.

**triangle**

A polygon with three sides.

U

underestimate

Make an estimate that is too small.

unit

A standard of measurement.

Examples:

Centimeters, pounds, inches, and so on.

Glossary

unit fraction

A fraction whose numerator is 1. It shows one equal part of a whole.

Example:



V

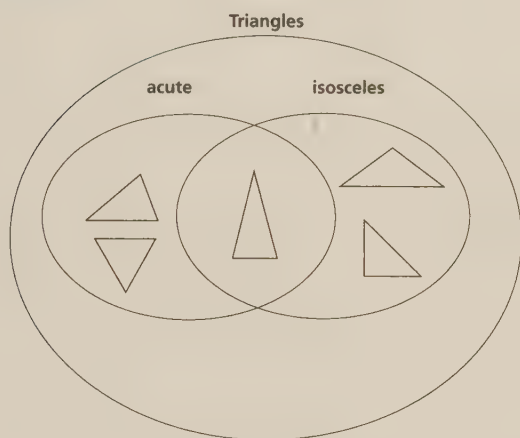
variable

A letter or a symbol that represents a number in an algebraic expression.

Venn diagram

A diagram that uses circles or other shapes to show how sets are related. Items that belong to more than one set are shown in the overlap.

Example:



vertex of an angle

A point that is shared by two sides of an angle.



vertex of a polygon

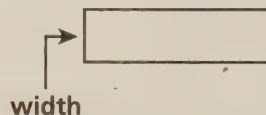
A point that is shared by two sides of a polygon.



W

width

The distance across the shorter side of a rectangle.



word form

The form of a number written using words instead of digits.

Example:

Six hundred thirty-nine

Y

yard (yd)

A U.S. customary unit of length equal to 3 feet.

4.ARO Algebraic Reasoning and Operations

4.ARO.1	Given a multiplication equation, such as $27 = 3 \times 9$, understand how to express it as a comparing situation (example: 27 is 3 <i>times as many as</i> 9 and 9 <i>times as many as</i> 3.) Write an equation given a multiplicative-comparison sentence expressed in words.	Unit 4 Lessons 4, 5, 6, 12
4.ARO.2	Solve word problems involving multiplicative comparison by multiplying or dividing; represent the problem by drawing a picture (or diagram) and writing an equation with a symbol for the unknown quantity. Understand the difference between multiplicative and additive comparison.	Unit 4 Lessons 4, 5, 6, 12
4.ARO.3	Use the four operations to solve multi-step word problems involving whole numbers and whole number answers. For division, interpret the remainder. Write an equation, with a letter for the unknown quantity, to represent a problem. Use mental math, compatible numbers, and estimation to determine if an answer is reasonable.	Unit 1 Lessons 8, 11, 12 Unit 2 Lessons 11, 15, 17, 18, 19 Unit 3 Lessons 8, 9, 10, 11, 14 Unit 4 Lessons 7, 8, 9, 12
4.ARO.4	Given a whole number 1–100, find all the pairs of <i>factors</i> for the number; understand that a whole number is a <i>multiple</i> of its factors. Given a whole number 1–100, find whether it is a multiple of given one-digit number. Decide if a number 1–100 is <i>prime</i> or <i>composite</i> .	Unit 4 Lessons 10, 12
4.ARO.5	Use numbers or geometric figures to create a pattern that follows a rule (including rules given using variables, e.g., $y = 3x + 5$). Describe other elements of the pattern that are not given in the rule.	Unit 1 Lesson 17 Unit 4 Lessons 10, 11, 12 Unit 8 Lesson 12
4.ARO.6	Create and use input-output rules involving addition, subtraction, multiplication, and division to solve problems in various contexts. Record the inputs and outputs in a chart or table.	Unit 1 Lesson 17 Unit 4 Lesson 11
4.ARO.7	Demonstrate fluency with multiplication and division facts.	Unit 1 Lessons 15, 16, 17, 18

4.PVO Place Value and Operations

4.PVO.1	Understand that the value of a digit in a multi-digit whole number depends on its place in the number; know that each place is 10 times the value of the place to its right.	Unit 1 Lessons 1, 2, 4 Unit 2 Lessons 2, 3
4.PVO.2	Use base-ten numerals, names of numbers, and expanded form to read and write multi-digit numbers. Compare and order multi-digit numbers by using a number line and by demonstrating understanding of the value of digits in each place; record the result using symbols $>$, $<$, and $=$.	Unit 1 Lessons 1, 2, 3, 4, 5 Unit 2 Lessons 4, 10, 12, 16, 19
4.PVO.3	Round multi-digit whole numbers to any place using place value.	Unit 1 Lessons 3, 5, 8, 11, 14 Unit 2 Lessons 5, 17 Unit 3 Lesson 8
4.PVO.4	Use the standard algorithms to add and subtract multi-digit whole numbers, demonstrating fluency.	Unit 1 Lessons 6, 7, 8, 9, 10, 11, 12, 13, 14 Unit 4 Lessons 1, 2, 12
4.PVO.5	Use strategies involving place value and properties of operations to multiply whole numbers containing one-through four-digits by a one-digit number; multiply two two-digit numbers. Use equations, arrays, and/or area models to represent and explain the computation.	Unit 2 Lessons 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19 Unit 3 Lesson 14 Unit 4 Lessons 1, 3, 12
4.PVO.6	Use strategies involving place value, properties of operations, and/or the relationship between multiplication and division, to divide whole number dividends with up to four digits by one-digit divisors or up to three digit dividends by two-digit divisors and express the quotients and remainders as whole numbers. Use equations, arrays, and/or area models to represent and explain the computation.	Unit 3 Lessons 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14 Unit 4 Lessons 1, 3, 12

4.FO Fractions and Operations

4.FO.1	Use fraction models to explain why a given fraction $\frac{a}{b}$ is equivalent to a fraction $n \times \frac{a}{n} \times b$; recognize that although the two fractions are the same size, the number and size of their parts are different. Apply this concept for recognizing and creating equivalent fractions.	Unit 7 Lessons 4, 5, 6, 13
4.FO.2	Compare and order fractions (including mixed numbers and fractions greater than 1) that have different denominators or numerators; use methods for comparing such as finding a common denominator or common numerator, or comparing to a benchmark fraction, e.g., $\frac{1}{4}$. Understand that to compare fractions, the size of the wholes must be the same. Use the symbols $>$, $<$, or $=$ to record results and justify the result with a model.	Unit 6 Lessons 2, 4, 5, 10 Unit 7 Lessons 1, 2, 3, 6, 13
4.FO.3	Recognize that a fraction $\frac{a}{b}$ with a numerator greater than 1, is the sum of unit fractions.	Unit 6 Lessons 1, 2, 4, 6
4.FO.3.a	Recognize when adding and subtracting fractions, the parts of the same whole are either joined or separated.	Unit 6 Lessons 2, 3, 4, 5, 6, 10
4.FO.3.b	Show different ways to decompose a fraction into the sum of fractions with the same denominators; record each result with an equation. Use a model to justify the decomposition.	Unit 6 Lessons 2, 4, 6, 9
4.FO.3.c	Know how to add and subtract mixed numbers with like denominators. Use methods such as writing each mixed number as an equivalent fraction using properties of operations and the relationship between addition and subtraction.	Unit 6 Lessons 5, 6, 9, 10
4.FO.3.d	Add and subtract fractions with like denominators to solve word problems; understand that like-denominators refer to the same whole. Represent the problem using fraction models and equations.	Unit 6 Lessons 3, 4, 6, 10
4.FO.4	Multiply a fraction and a whole number by applying and extending prior knowledge of multiplication.	Unit 6 Lessons 7, 8
4.FO.4.a	Recognize that fraction $\frac{a}{b}$ is a multiple of a unit fraction, $\frac{1}{b}$.	Unit 6 Lessons 1, 7, 8
4.FO.4.b	Given a fraction $\frac{a}{b}$, recognize that a multiple of the fraction is also a multiple of $\frac{1}{b}$, apply this understanding to multiply a fraction and a whole number.	Unit 6 Lessons 7, 8, 9
4.FO.4.c	Multiply a fraction and a whole number to solve word problems; represent the problems using models and equations.	Unit 6 Lessons 7, 8, 10

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4.FO.5	Given a fraction with a denominator of 10, find an equivalent fraction with a denominator of 100; use this method to add a fraction with a denominator of 10 and a fraction with a denominator of 100.	Unit 7 Lesson 6
4.FO.6	Write a fraction with a denominator of 10, 100, or 1000 as a decimal.	Unit 7 Lessons 8, 9, 10, 11, 13, 14
4.FO.7	Compare and order decimals by reasoning about their size and by using place value. Understand that to compare decimals the numbers must refer to the same whole. Use the symbols $>$, $<$, or $=$ to record the result and justify the comparison with a model.	Unit 7 Lessons 10, 12, 13, 15
4.FO.8	Round decimals to the nearest tenth.	Unit 7 Lesson 16

4.MDA Measurement and Data Analysis

4.MDA.1	Understand the relative size of units of measure within a given system including, metric (cm, m, km; g, kg; mL, L), customary (oz, lb) and time (s, min, h). Within a given measurement system, rewrite measurements expressed in larger units as smaller units. Use a two-column chart to record equivalent measurements.	Unit 5 Lessons 1, 2, 3, 4, 5, 7, 8
4.MDA.2	Solve word problems involving money, time, distance, liquid volume, and mass using the four operations. Solve problems that contain simple fractions or decimals, and that require rewriting a measurement expressed in a larger unit as a smaller unit. Draw a diagram such as a number line to represent measurements; label the scale of the number line in the given units.	Unit 1 Lessons 6, 13, 14 Unit 2 Lessons 4, 6, 10, 11, 18, 19 Unit 3 Lessons 8, 14 Unit 4 Lessons 7, 8, 12 Unit 5 Lessons 1, 2, 3, 4, 5, 7, 8 Unit 6 Lessons 3, 6, 7, 8, 9, 10 Unit 7 Lessons 10, 11
4.MDA.3	Use the formulas for perimeter and area of rectangles to solve real world or other mathematical problems. Find areas of real-world objects that can be divided into rectangular figures.	Unit 5 Lessons 6, 7, 8
4.MDA.4	Display data involving measurements given in fractions of a unit (example: $\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$) on a line plot. Use the data from the line plot to solve problems involving addition and subtraction of fractions.	Unit 5 Lesson 3 Unit 6 Lesson 6 Unit 7 Lessons 7, 13
4.MDA.4.a	Use tables, bar graphs, timelines, and Venn diagrams to display data sets.	Unit 1 Lessons 3, 14 Unit 4 Lesson 11 Unit 5 Lessons 2, 3, 4, 5 Unit 8 Lessons 4, 8
4.MDA.5	Recognize that angles are geometric figures formed by two rays with the same endpoint. Understand angle measurement concepts.	Unit 8 Lessons 1, 2, 3

4.MDA.5.a	Understand that angle measurement is based on the rotation of rays with the same endpoint at the center of a circle and the fraction of the arc formed by the two rays intersecting the circle. Recognize that a one-degree angle (an angle rotation of $\frac{1}{360}$ of a circle) can be used to measure angles.	Unit 8 Lessons 2, 3
4.MDA.5.b	Recognize that an angle that rotates through n one-degree angles has an angle measurement of n degrees.	Unit 8 Lessons 2, 3
4.MDA.6	Use a protractor to measure angles in whole-number degrees. Draw angles of given measures.	Unit 8 Lessons 2, 3, 5
4.MDA.7	Understand that an angle can be separated into parts that do not overlap and the <i>sum of the angle measures of the parts</i> is the angle measure of the whole. Recognize that angle measure is additive. Solve problems involving addition and subtraction to find the measure of an unknown angle presented in a diagram of real-world situations and other mathematical contexts; use an equation with a symbol for the unknown angle to represent the problem.	Unit 8 Lessons 3, 5, 6

4.GSR Geometry and Spatial Reasoning

4.GSR.1	Identify and draw points, lines, line segments, rays, angles (right, acute, obtuse), parallel lines, perpendicular lines, and intersecting lines, and recognize them in two-dimensional figures.	Unit 8 Lessons 1, 2, 3, 4, 5, 7, 8, 9, 10, 12
4.GSR.2	Classify two-dimensional figures by determining whether or not they have parallel or perpendicular lines, or angles of a given size. Describe, classify and draw quadrilaterals, including squares, rectangles, trapezoids, rhombuses, parallelograms and kites. Identify right triangles and understand that they comprise a specific category of triangles.	Unit 8 Lessons 4, 8, 9, 10, 12
4.GSR.3	Recognize that when a two-dimensional figure can be folded along a line into matching parts, the fold-line is called a <i>line of symmetry</i> . Identify figures with line symmetry.	Unit 8 Lessons 11, 12
4.GSR.4	Apply translations (slides) to figures.	Unit 8 Lessons 13, 14
4.GSR.5	Apply reflections (flips) to figures by reflecting over vertical or horizontal lines and relate reflections to lines of symmetry.	Unit 8 Lessons 13, 14
4.GSR.6	Apply rotations (turns) of 90° clockwise or counterclockwise.	Unit 8 Lessons 13, 14
4.GSR.7	Recognize that translations, reflections and rotations preserve congruency and use them to show that two figures are congruent.	Unit 8 Lessons 13, 14

MPP1

Problem Solving

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MPP2

Abstract and Quantitative Reasoning

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MPP3

Use and Evaluate Logical Reasoning

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MPP4

Mathematical Modeling

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MPP5

Use Mathematical Tools

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MPP6

Use Precise Mathematical Language

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MPP7

See Structure

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MPP8

Generalize

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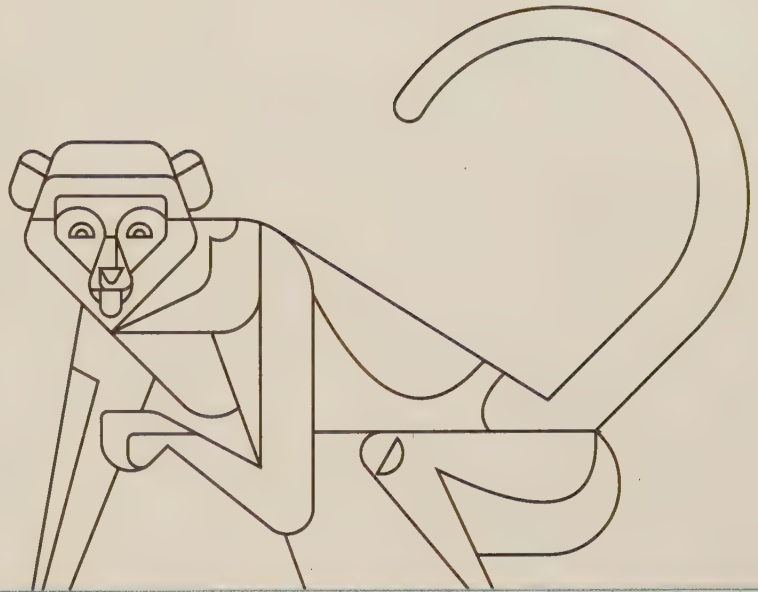
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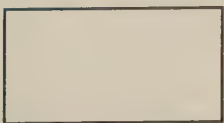
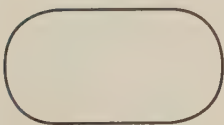
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